THE EFFECT OF TRAINING ON CONTROLLED EXPERIMENTATION DURING ADOLESCENCE

THESIS
submitted to
University of Rajasthan, Jaipur
For the Degree of
Doctor of Philosophy
in Education
1987

Supervised by :
Prof. N. VAIDYA
Principal,
Regional College of Education, Ajmer

By :
ANU POONIA

CERTIFICATE

This is to certify that Mrs. Anu Poonia, Lecturer, Vidya Bhawan Govind Ram Seksaria Teachers' Training College, Udaipur, has conducted and completed the Ph.D. thesis entitled "THE EFFECT OF TRAINING ON CONTROLLED EXPERIMENTATION DURING ADOLESCENCE" under my guidance and supervision.

Her work is genuine and original.

N Vaidya

(Prof. N. Vaidya)
Principal
Regional College of Education
AJMER (Rajasthan)

December , 1987.

ACKNOWLEDGEMENT

The investigator express her sincere gratitude to her reverend guide Prof. N. Vaidya, Principal, Regional College of Education, Ajmer, for the guidance and inspiration that she received at every stage of this study, developing a love for research and creating a deep interest in Jean Piaget and his works.

The investigator is very much thankful to Dr. S.C. Jain, Lecturer, Regional College of Education, Ajmer and Dr. A.B. Phatak, Principal, Mahesh Teachers' College, Jodhpur, for their valuable suggestions and patient clarification to various problems encounted through the study.

The investigator also wishes to thank her parents for motivating her to take up this research work. She is grateful to her husband, Ravi, for his deep understanding, patience and unending help through every step of the work. She is obliged to her brother Joseph for helping in getting the tools printed.

The investigator is obliged to the Principal, staff and the students of St.Paul's Higher Secondary School, St, Mary's Convent Higher Secondary School and St.Teresa Secondary School, Udaipur for their cooperation.

Lastly, the investigator is thankful to Mr.Mohan Singh Chauhan for his prompt and efficient typing.

Anu Poonia

December , 1987. ANU POONIA

CONTENTS

PAGE No.

CHAPTER - I THE PROBLEM AND ITS SIGNIFICANCE 01-62

1. INTRODUCTION .. 01
2. STATEMENT OF THE PROBLEM 03
3. PURPOSE OF THE STUDY .. 03
4. IMPORTANCE OF THE STUDY.. 04
5. SOME DISTINGUISHING FEATURE OF THE STUDY .. 05
6. DEFINITIONS OF THE KEY TERMS USED .. 06
    a) Effect of 'training' and acceleration of training 07
    b) Some conditions of upward stage change .. 18
    c) Adolescent thinking - General characteristics 19
        i) Real versus Possible 25
        ii) Empirico-Inductive versus Hypothetical deductive 26
        iii) Intrapropositional versus Interpropositional 27
        iv) Combinations and Permutations .. 30
        v) Inversion and Compensation .. 31
        vi) Information processing strategies .. 32
        vii) Consolidation and Solidification 33
    d) Concrete Operational Thinking 34
        i) The origin of concrete logic .. 35
        ii) Principals of concrete logic .. 35
    e) Controlled Experimentation 36
        i) Nature of experimental used outside the experiment to prepare the matched groups 38
        ii) Determining extraneous variables ... 40

7. PIAGETIAN THEORY - SOME BASIC IDEAS 41
- a) Piaget's concept of intelligence 42
- b) The cognitive structure .. 44
- c) The scheme 45
- d) Cognitive functions .. 46
- e) Cognitive contents .. 48
- f) Operations 48
- g) Assimilation and accomodation.. 48
- h) Equilibrium 50
- i) Grouping of Thought .. 51
- j) Piagetian 'stages' of development 53

8. OBJECTIVES OF THE STUDY .. 59

9. HYPOTHESES 60

10. DELIMITATIONS OF THE STUDY .. 61

CHAPTER - II REVIEW OF THE RELATED LITERATURE 63-81

1. INTRODUCTION 63
2. TEACHING STUDIES .. 64
3. MAIN FINDINGS EMERGING OUT OF THE RELATED LITERATURE .. 77
4. CONCLUDING STATEMENT .. 80

CHAPTER-III PLAN AND PROCEDURE 82-132

1. INTRODUCTION 82
2. EXPERIMENTAL DESIGN .. 83
   - a) Procedure for stimulating problems 83
   - b) Procedure for Pre test .. 84
   - c) Training sessions .. 85
     - i) First training session .. 85
     - ii) Second training session .. 87
     - iii) Third training session .. 87
   - d) Post test 87
3. DESCRIPTION, ADMINISTRATION AND SCORING PROCEDURE OF THE TOOLS 88

a) Raven's progressive matrix .. 88
  i) Administration .. 89
  ii) Scoring 90
b) Socio-economic status Questionnaire .. 90
  i) Administration .. 92
  ii) Scoring procedure .. 92
c) Cattell's H.S.P.Q. .. 94
  i) Administration .. 103
  ii) Scoring 103
d) Piagetian tasks .. 104
  i) Administration .. 121
  ii) Scoring procedure .. 128
4. SELECTION OF THE SAMPLE .. 128
5. STATISTICAL TECHNIQUES USED .. 131

CHAPTER-IV RESULTS OF DESCRIPTIVE STATISTICAL ANALYSIS, DISCUSSIONS AND CONCLUTIONS 133-229
1. INTRODUCTION 133
2. ANALYSIS OF THE RESPONSES .. 133
a) Levels of intellectual development 134
b) Number of boys, girls and the total sample present during the Pre test and Post test .. 135
c) Number of boys at concrete, transitional and formal operational stage in each task for control and experimental group 138
d) Number of boys at concrete, transitional and formal operational level in each task at Pre test for control and experimental group .. 139
e) Number of girls at concrete, transitional and formal operational level of intellectual development at Pre test for control and experimental group 140
f) Number of girls at concrete, transitional and formal operational level of intellectual

development at Post test for both control and experimental group 141

g) Number of boys of control group at concrete, transitional and formal operational level at Pre test and Post test .. 143

h) Number of boys of experimental group at concrete, transitional and formal operational level of intellectual development for . . Pre test and Post test .. 147

i) Number of girls of experimental group at concrete, transitional and formal operational level of intellectual development at Pre test and Post test .. 148

j) Number of girls of control group at concrete, transitional and formal operational stage at Pre test and Post test .. 151

k) Number of boys and girls at concrete, transitional and formal operational level at Pre test of control group .. 153

l) Number of boys and girls of control group at concrete, transitional and formal operational level at Post test .. 155

m) Number of girls and boys of experimental group at concrete transitional and formal operational level during Pre-test 157

n) Number of boys and girls of experimental group at concrete, transitional and formal operational level at Post test .. 161

3. ANALYSIS OF MEAN AND STANDARD DEVIATION OF EACH TASK AND TOTAL SCORES FOR THE PRE TEST OF BOYS AND GIRLS AT DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT FOR BOTH CONTROL AND EXPERIMENTAL GROUP 165

a) Mean, Standard Deviation of scores of each task for the Post-test of boys and girls and total sample at different level of intellectual development 168

b) Mean, standard deviation of each task and total of all the tasks for the Pre test and Post test of boys and girls of control group at different levels of intellectual development 169

c) Mean, standard deviation of each task and total scores of Pre test and Post test of experimental group at different levels of intellectual development. 170

d) Level of intelligence, range of scores, their means and standard deviations. 171

e) Socio-economic status, its mean, and standard deviation of the entire sample for control and experimental group. .. 175

f) Personality factors, its mean, and standard deviation of the entire sample for control and experimental group. .. 176

g) The performance of boys at the three levels of intellectual development during the three training sessions 179

h) The performance of girls at the three levels of intellectual development during the three training sessions. 188

i) Percentage of boys of control and experimental group present at different levels of intellectual development during Pre test and Post test 198

j) Percentage of boys of control and experimental group present at the three levels of intellectual development during Post test 200

k) Percentage of girls of control and experimental group present at different levels of intellectual development during Pre test and Post test 201

l) Percentage of girls of control and experimental group present at the three levels of intellectual development during Post test .. 203

m) Percentage of boys and girls of control group present at the different levels of intellectual development during Pre test and Post test 204

n) Percentage of boys and girls of control group present at different levels of intellectual development during Post test .. 206

o) Percentage of boys and girls of experimental group at the different levels of intellectual development during Pre test and Post test 206

p) Percentage of boys and girls of experimental group present at the different levels of intellectual development during the Post test 208

q) Grade wise / age wise performance of the experimental group for each task 209

r) Performance of the students as a result of different mode of presentation 221

CHAPTER - V **RESULTS OF INTERNAL STATISTICAL ANALYSIS DISCUSSIONS AND CONCLUSIONS** 230-283

1. INTRODUCTION .. 230
2. HYPOTHESES .. 230
   - a) Hypothesis No.1 .. 232
     - i) Procedure .. 236
     - ii) Results .. 236
   - b) Hypothesis No.2 .. 245
     - i) Procedure .. 262
     - ii) Results .. 262
   - c) Hypothesis No.3 .. 265
     - i) Procedure .. 266
     - ii) Results .. 270
   - d) Hypothesis No.4 .. 273
     - i) Procedure .. 273
     - ii) Results .. 274
   - e) Hypothesis No.5 .. 275
     - i) Procedure .. 277
     - ii) Results .. 277
   - f) Hypothesis No.6 .. 278
     - i) Procedure .. 278
     - ii) Results .. 278
   - g) Difference with the obtained results in Pre test and Post test and those which were expected theoritically on the hypotheses .. 281
     - i) Procedure .. 282
     - ii) Results .. 283
     - iii) Discussion .. 283

CHAPTER - VI **ANALYSIS OF MATHEMATICAL STRUCTURES FOR ADOLESCENT THOUGHTS UNDERLYING THE PROBLEMS IN PIAGETIAN CONTEXT AND OTHER VARIABLES** 284-312

1. INTRODUCTION .. 284
2. SOME BACKGROUND STUDIES 285

3. THE PRESENT STUDY .. 289

4. HYPOTHESIS .. 290

    a) Correlation Matrix 290

    b) Obtaining the factors 292

    c) Factoring of correlation matrix .. 292

    d) Significance of factors using Scree Test .. 296

    e) Interpretation of the factors and discussions .. 298

        i) Factor I ..
        ii) Factor II ..
        iii) Factor III ..
        iv) Factor IV ..

    f) Results .. 304

5. THE CURRENT PICTURE OF THE STRUCTURE FOR PIAGETIAN THOUGHT 305

CHAPTER-VII SUMMARY AND EDUCATIONAL IMPLICATIONS 313-326

1. INTRODUCTION .. 313

2. REVIEW OF RELATED LITERATURE 313

3. KEY STATEMENTS FROM THE STUDIES 314

4. DISTINGUISHING FEATURES OF THE STUDY .. 315

5. AIMS AND OBJECTIVES .. 316

6. HYPOTHESES .. 317

7. THE SAMPLE .. 318

8. METHODOLOGY .. 319

    a) State I .. 319

    b) Stage II .. 320

    c) Stage III .. 320

9. SCORING PROCEDURE .. 320

10. MAIN FINDINGS .. 321

11. CONCLUSIONS .. 322

12. EDUCATIONAL IMPLICATIONS 323

13. AREAS FOR FURTHER RESEARCH 325

BIBLIOGRAPHY 327-349
1. BOOKS .. 327
2. JOURNALS .. 334
3. RESEARCH REPORTS AND THESIS 341
APPENDICES 344-
1. APPENDIX No.1 - Raw scores of control group - boys and girls for the various variables dealt with the study ..
2. APPENDIX No.2 - Raw scores of experimental group boys and girls for the various variables dealt with in the study ..
3. APPENDIX No.3 - List of variables dealt with in the study
4. APPENDIX No.4 - Test Questionnaires :
    a) Stimulating problems
    b) Pre test ..
    c) Training sessions
    d) Post test ..
    e) Socio-economic status questionnaire ..
    f) High School Personality Questionnaire ..

LIST OF TABLES

TABLE No. PAGE No.

1. The distinguishing characteristics of stages 64
2. Training studies showing positive influence 64
3. Training studies showing neutral influence 72
4. Training studies showing negative influence 75
5. Training studies showing doubtful influence 76
6. Characteristic expressions of the traits (Personality) .. 95
7. Piagetian task used in the study .. 105
8. Selection of the problem .. 106
9. Reliability of the Piagetian tasks 108
10. Scoring procedure for Piagetian tasks 122
11. Expected performance for the Questions of each task, their level of cognitive development and scoring .. 123
12. Division and selection of the sample 130
13. Numbers of boys and girls and the total sample of control and experimental group finally selected for the Pre test and the Post test 126
14. Number of students of control and experimental group at concrete, transitional and formal operational level of intellectual development during the Pre test and the Post test for different sex, age, grade and Piagetian tasks 137

15. Mean, standard deviation of each task scores for the Pre test and the Post test of boys and girls at different level of intellectual development 166

16. Intelligence scores, mean and standard deviation of the sample selected for the study .. 172

17. Socio-economic status, its mean and standard deviation of the sample selected 174

18. Personality factors, its mean and standard deviation of the entire sample for control and experimental group 177

19. The performance of boys at the three level of intellectual development during the three training sessions 178

20. The performance of girls at the three levels of intellectual development during the three training sessions 189

21. Grade wise and age wise performance in percentage of experimental groups for each task 210

22. Percentage of the students' performance as a result of different mode of presentation 222

23. Performance of girls and boys of lower grades for Pre test and Post test of the control and experimental group 225

24. Difference in the mean and S.D. of the Pre test and Post test scores for different tasks with respect to control and experimental group sex wise, grade wise and age wise .. 226

25 Difference in the Pre test and Post test scores for different grades and age of boys of the control and experimental group .. 235

26. Difference in the Pre test and Post test scores for different grades and age of girls of the control and experimental group 237

27. Difference between the Pre test scores for each grade of the control and the experimental group of boys and girls 239

28. Difference between the Post test scores for each grade of the control and experimental group of boys and girls 240

29. Difference between the scores of each problem for Pre test of boys and girls of each grade of control and experimental group .. 242

30. Difference between the Pre test scores of boys and girls of control and experimental group .. 243

31. Difference in the three levels of intellectual development and the performance of control and experimental group of boys during Pre test 250

32. Difference in the three levels of intellectual development and the performance of girls of control and experimental group during Pre test 251

33. Difference in the three levels of intellectual development during the performance of Post test for control and experimental group of boys 252

34. Difference in the three levels of intellectual development during the performance of girls for Post test for experimental and control group 253

35. Difference in the three levels of intellectual development and the performance of boys of control group during Pre test and Post test 254

36. Difference in the three intellectual levels and the performance of boys

of experimental group for Pre-test and Post test .. 255

37. Difference between the three intellectual levels and the performance of girls of control group during Pre test and Post test 256

38. Difference in the three levels of intellectual development and the performance of the girls of experimental group for pre test and post test 257

39. Difference in the three intellectual levels of development and the performance of control group during Pre test and Post test boys and girls 258

40. Difference in the three level of intellectual development and the performance of control group of boys and girls during Post test 259

41. Difference in the three levels of intellectual development and the performance of experimental group during the Pre test of boys and girls 260

42. Difference in the three levels of intellectual development during the performance of boys and girls of experimental group at Post test 261

43. Difference in the scores of each problem for first and last training session at the three levels of intellectual development of boys and girls 267

44. Difference in the scores of each problem of boys and girls for the first and the last training session 268

45. Difference in the scores for each problem of boys and girls for the first and the last training session for each grade and sex .. 269

46. Difference in the performance of boys and girls of experimental group for the Post test as a result of different mode of presentation for the problem 273

47. Relationship between intelligence and Pre test, Post test of control and experimental group .. 276

48. Relationship between personality traits and scores of pupils showing favourable influence due to training 279

49. Relationship between intelligence and Post test scores of favourably influenced by training .. 280

50. Value of Chi-Square for three level of intellectual development and Pre test, Post test value for experimental and control group of boys and girls 282

51. Correlation matrix for factor analysis 291

52. Principal factor matrix .. 293

53. Varimax rotated factor matrix .. 294

54. Six factors having Eigen value greater than unity .. 295

55. Original factor 1, significant loadings 299

56. Varimax rotated factor I, significant loadings 299

57. Original factor II, significant loading 300

58. Varimax rotated factor II, significant loading .. 301

59. Original factor III, significant loading 302

60. Varimax rotated factor III significant loading .. 303

61. Original factor IV, significant loading 304

62. Varimax rotated factor IV significant loading .. 304

63. Psychological nomenclature of the factors 305

64. Factorial structure of the adolescent thoughts .. 306

LIST OF GRAPHS

GRAPH No.	Description	PAGE No.
1.	Performance of boys at the three levels of intellectual development during the three training sessions - Problem 1	182
2.	Performance of boys at the three levels of intellectual development during the three training sessions - Problem 2	183
3.	Performance of boys at the three levels of intellectual development during the three training session - Problem 3	184
4.	Performance of boys at the three levels of intellectual development during the three training sessions - Problem 4	185
5.	Performance of boys at the three levels of intellectual development during the three training sessions - Problem 5	186
6.	Performance of boys at the three levels of intellectual development during the three training sessions - Total of all the problem	187
7.	Performance of girls at the three levels of intellectual development during the three training sessions - Problem 1	192
8.	Performance of girls at the three levels of intellectual development during the three training sessions - Problem 2	193
9.	Performance of girls at the three levels of intellectual development during the three training sessions - Problem 3	194
10.	Performance of girls at the three levels of intellectual development during the three training sessions - Problem 4	195
11.	Performance of girls at the three levels of intellectual development during the three training sessions - Problem 5	196

12. Performance of girls at the three levels of intellectual development during the three training sessions - Total of all the problems 197

13. Percentage of boys of control and experimental group at the different levels of intellectual development for Pre test and Post test 199

14. Percentage of girls of control and experimental group at the different levels of intellectual development for Pre test and Post test 202

15. Percentage of boys and girls of control group at the different levels of intellectual development for Pre test and Post test 205

16. Percentage of boys and girls of experimental group present at the different levels of intellectual development for Pre test and Post test 207

17. The performance of boys of experimental group grade VII, age 11+, for each task at the three levels of intellectual development for Pre test and Post test 213

18. The performance of boys of experimental group grade VIII, age 12+, for each task at the three levels of intellectual development for Pre test and Post test 214

19. The performance of boys of experimental group grade IX, age 13+, for each task at the three levels of intellectual development for Pre test and Post test 215

20. The performance of boys of experimental group grade X, age 14+, for each task at the three levels of intellectual development for Pre test and Post test 216

21. The performance of girls of experimental group grade VII, age 11+, for each task at the three levels of intellectual development for Pre test and Post test 217

22. The performance of girls of experimental group grade VIII, age 12+, for each task at the three levels of intellectual development for Pre test and Post test 218

23. The performance of girls of experimental group grade IX, age 13+, for each task at the three levels of intellectual development for Pre test and Post test 219

24. The performance of girls of experimental group grade X, age 14+, for each task at the three levels of intellectual development for Pre test and Post test 220

25. Performance of boys and girls for each task at the Post test using different modes of presentation 222

26. Factors analysis - Graphic relationship between the six factors and their Eigen values 297

CHAPTER - I

THE PROBLEM AND ITS SIGNIFICANCE

INTRODUCTION :

Piaget's theory of cognitive development has had a considerable influence on our thinking about the education of young children for many years. It is felt that education is a very powerful tool in capturing the minds of man and shaping them in the direction that is safe and desirable. Piaget laid emphasis on learning, divergent thinking, learning from working, learning by discovery and creativity. His insistance on the importance of experience involving direct actions upon objects as a necessary precursor to concept formation and learning has lent support to thos who advocate an activity based environment for young children.

According to Piaget, knowledge is constructed both from the data of experience and from the data provided by the biological characteristics of the organism. The data of experience received through sensations and perceptions are incorporated into and integrated with existing structures in the mind through the action of intellectual operations. Activity is the means by which growth of cognitive structures comes about and activity is the functioning of these structures. Activity nourishes the structures that guide the activity.

Activity is the means and cultivation of structures to the end. This means that knowledge is constructed in the minds of the individual by means of a self-regulatory mental mechanism.

Development of the capacity to construct knowldge proceeds by stages in the development of the individuals. Mental mechanism processes become functional only with the maturation of the individual. Experience may have the effect of accelerating or delaying mental development but it will not alter its essential character.

The origin of thought is not to be found in the data of sensation or perception but in actions, that is, in mental activity involving functions associated with prelogical and logical operations. Operativity which may involve the use of sensary and perceptual data, leads to the construction of knowledge.

The abilities to conserve fundamental qualities to classify, to hypothesis, to control variables and to exhibit proportional reasoning are of importance not only to Piagets model but also to the thinking expected in classrooms. Hence studies in which investigators have attempted to accelerate the acquisition of these abilities by training are important both theoritically and practically.

It appears that the research in cognitive development has yet to reach its peak and work stimulated by and addressing itself to Piagetian questions will dominate the field. Besides replication and extension to a new task or materials and training studies, various applications of Piagetian notions to testing, educational practice, etc. are also gaining frequencies. With the increasing interest in application of Piagetian theory for curriculum design and evaluation, the use of Piagetian formal operational tasks to quantify gains in intellectual development has and will continue to become more widespread.

STATEMENT OF THE PROBLEM :

Experience with concrete materials motivates learning. Activity oriented classroom instructions promote the reasoning patterns and intellectual developments. So training in certain concepts and various scheme of thought should bring about an improvement in performance practically in every type of logical and infralogical operations. In other words is acceleration of intellectual development possible through training specifically from concrete stage through a formal stage ? In a broader sense the proposed study may be stated as "THE EFFECT OF TRAINING ON CONTROLLED EXPERIMENTATION DURING ADOLESCENCE".

PURPOSE OF THE STUDY :

The purpose of the study is to investigate if training helps to accelerate the intellectual development, through

controlled experimentation, the groups being matched against intelligence, socio-economic status, age and grade.

Another purpose is to see the difference in the performance of students of both the control and the experimental groups sex-wise, age-wise and grade-wise.

IMPORTANCE OF THE STUDY :

The practical contribution of the study can be assessed from the perspective of general educational practice, curriculum building and specific teaching strategies. The training techniques could be applied to acquire various scientific concepts.

The significance rests upon the contribution to cognitive development theory as well as to educational practice. It is evident that no single type of training is equally effective for all kinds of problems. Verbal and non-verbal procedures have different effect depending upon the class of problems or the subject area in a question. The effectiveness of training technique may ascertain whether the induced changes are truely inductive of cognitive re-organization. Undoubtedly, the effectiveness of training is mutually dependent upon the developmental level of the child, the class of problem and the kinds of training techniques used.

Brunner (1966) and Piaget (1971) have stressed that children are most likely to develop intellectually when they

are allowed to work with equipments. This study is important in the sense that it determines the responses of the children to an experimental environment.

Such techniques can also provide valuable guidelines for the educators, a criteria for analysing the sequences in the curriculum units and assess teaching strategies related to the curriculum construction.

SOME DISTINGUISHING FEATURES OF THE STUDY:

The study attempts to find out the effect of training on the intellectual development in a wider frame of reference. This study is different from the various studies gone through by the investigator in the following manner :

1. It uses matched groups. The pupils belonging to the controlled and the experimental group were matched against age, grade, intelligence and socio-economic status.
2. Both adolescent boys and girls selected for the study varied over a wide age range from 11+ to 15+ and intelligence.
3. The study classified individual adolescent pupils at the three level of intellectual development, namely, concrete, transitional and formal.

4. The study investigated the influence of training at each of the above mentioned levels of Intellectual Development both within the age group and across the age group as well.

5. It attempted to determine the personality characteristics of pupils who are favourably influenced by training.

6. It attempted to determine the differences in mathematical structures of task and tests used through factor analysis.

7. It rises different mode of presentation for the problems.

8. The study used group testing method for pretest, training sessions and post test.

9. It considers two schemes of thought for training.

10. It uses stimulating problems prior to pre-test.

DEFINITIONS OF THE KEY TERMS USED:

Piaget considers that certain processes underlie all learning whether in simple organisms or in human beings. The two essential processes are on the one hand adaptation to the environment and on the other, organization of experiences by means of actions and perceptions, memory and other kinds of cognitive activities. A simple organism's adaptation is a

matter of living to satisfy elementary needs, and organization is rudimentary. The human child adapts to a succession of environment as he develops.

Effect of 'training' and acceleration of learning :

Experiments in which children are trained to acquire concepts from Piaget's stages have been the abiding theme in the cognitive development literature, for the last decade. According to Piaget the four factors necessary for intellectual development are :

1) Maturation
2) Concrete experience
3) Social transmission
4) Self-regulation (equilibrium)

According to him, learning occurs only when two conditions are met. Firstly, the training treatment incorporates laws of spontaneous development. Second, the to be trained subjects already posses the to be learned concepts to some measurable extent. Some suggestions to find out whether accelerated learning has occured or not are -

(a) What is the durability of the learning ?

(b) What is the value in regard to generalization as well as transfer to related and unrelated structures ?

(c) What is the difference in operational level or competence before and after the experience as judged by the availability of spontaneous operations ?

The training study value resides in their contribution to theoritical and practical question. On the theoritical side, these studies concern themselves with the learning conditions necessary for knowledge acquisition, the generalizability of these knowledge, and the basic modifiability of the organism at various developmental levels. The resultant changes in cognitive structure as a function of only certain training conditions, highlight the fact that modification appears to be the consequence of the interaction of the method of training, the content area involved and the developmental level of the particular child.

Piaget (1964) has discussed three criteria as vital in ascertaining whether a researcher has succeeded in teaching operational structures. (1) Durability of learning (2) Generalization or transfer to related cogntive strategies (3) Piaget's third criterion is best described in his own words - in the case of each learniing experience what was the operational level of the subject before the experience and what more complex structure has this subject succeeded in learning ? We must look at each specific learning experience from the point of view of the spontaneous operations which were present

at the outset and the operational level which has been achieved after the learning experience (Piaget, 1964).

Another criterion is formulated by Smedslund (1961) as the resistance to extinction. In an experiment designed to induce conservation after training tended to extinguish their conservation behaviour when the examiner surreptitiously removed some clay from one of the two objects. Whereas another group of children who were operational on conservation spontaneously tended to resist extinction.

The success of a training might depend upon (a) child's level of development at the beginning of training (b) the training method employed (c) the particular task used (d) amount of training (e) the criteria used to evaluate success.

Under certain conditions, an acceleration of cognitive development would be possible if the training procedures somewhat resembled the kinds of situations in which progress takes place outside an experimental set up. Training procedures should take into account the fact that new structures are formed through the integration and co-ordination of already existing schemata (pre-concepts). Training procedure should steer the subject in the right direction even if this results temporarily in incorrect reasoning. Variations are, however, possible and it is certainly not true that for each acquisition there is only one predetermined construction process.

Thus in training methods, the subject's creative capacities are encouraged rather than suppressed.

In order to detect learning there has to be a noticeable improvement as a function of learning. What is meant by improvement is the 'criterion problem', which is the source of continuous debate between the Genevan and the non-Genevan researches. According to Genevan investigators, only acceptable improvement consists of general advances on several dependent variables. To have gained through training a subject must : (a) give correct answers on a repetition of the pretest for that concept; (b) give correct answers on a test for that concept that uses different stimuli than the pretest; (c) give logically acceptable explanations for the answers on (a) and (b); (d) pass a test for atleast one other similar type task and (e) continue to meet criteria (a) and (b) several days after training. The non-Genevan investigators point out that (a), (b) and (c) are more than sufficient evidences to prove that learning has occured.

Training is closely associated with the acceleration of cognitive development. In Piaget's theory cognitive development is a stage like process in which learning is always'subject to the general constraints of the current development state", and consequently is believed to "vary very significantly as a function of the initial cognitive levels of the children". (Piaget, 715).

Each stage is characterized by its own unique set of mental structures. When they are in a given stage, children generate the concept associated with that stage from their mental structures in roughly the same manner that a mathematician generates theorems from previously given rules or inferences. Teaching children to acquire such concepts is described as teaching them how to apply their mental structures to new content. Unless the structures appropriate to a given concept are already present, learning cannot operate to induce the concept. If a child's current stage is several steps below the one at which a given concept spontaneously emerges, then training the concept is 'completely useless' because the relevant structures are absent. But if a child is at or only slightly below the correct stage, the relevant structures will be present and learning may take place.

According to Hermina Sinclair development is always the result of interaction. The subject himself is the mainspring of his development, in that it is his own activity in environment or his own reaction to the environmental actions that make progress. Learning is dependent on development not only in the sense that certain things can be learned only at certain levels of development but also in the sense that in learning, that is, in situations specifically constructed so that the subject has active encounters with environment the same mechanisms as in development are at work to make for progress, and if there is progress the same structure results.

The fact that in different cultures and sub-cultures the same line of development is found although acquisition ages vary according to whether or not the child is exposed to a stimulating social environment shows that environment can accelerate or retard development, but only rarely can it change its course.

Besides environment there are other factors which play a prominent role in the acceleration of cognitive development. In the words of Inhelder _et_ _al_. acceleration of cognitive development "could only occur if the training procedures in some way resembled the kind of situation in which progress takes place outside an experimental set up", that is, the training study must present the subject with experience which optionally map into his current structures at a point where the subject recognises restructuring to be necessary. The experience would demand action from the subject and the requisite action would be located in the general and spontaneous trends of intellectual growth.

To establish that development has actually taken place, a set of criteria is necessary for judging the outcomes of the interventions. To check the cognitive growth the subjects' post training behaviour must show real "comprehension" and complete understanding. For this the design of post tests should show -

1. That new acquisitions are manifested by the deployment of developmentally more mature judgements supported by appropriate explanations.
2. That these judgements should be durable.
3. That acquired operations should generalise to materials not used in the training study.
4. That operations implicit in the trained operations are available.
5. That newly acquired operations be resistant to experimental extinction (Brown and Desforges, 145).

Can the mental structures be accelerated or not is a very dubious question. In regard to this nature many psychologist have given their views. Let us begin with the Genevan viewpoint. According to Jean Piaget intellectual development takes place in four stages, its prominant distinguishing characteristics being aptitude, variation and specialization etc. When the period of learning is quite large it is not sensible to accelerate learning. This viewpoint cannot be accepted because tested evidence is pouring in which shows that concrete reasoning is present even among those who are about to leave adolescence far behind. It is found to come true even in our country where majority of children either do not go to school, go to school but do not stay there, or go to

school but do not show improved thinking characteristic of that age. For either category, knowledge about accelerated thinking is briefly desirable, whereas his work is silent on this. He does not offer suggestions which show whether accelerated thinking has occured or not.

According to Vygotskey instruction precedes development. He analyses intellectural development as a function of instruction explicitly. For him concepts do not exist in isolation. Each concept is a measure of "generality" and they interact with each other. Each concept throws light on lower concepts. Further he distinguishes between many types of concepts, namely, everyday concepts (spontaneous) that develop in opposite direction but it is the instruction which is the main source of child's ideas which corrects, informs and develops his knowledge. Instruction is not something external but is seen to be integrated closely with development. So planned instruction can accelerate mental development (cognitive functions).

Z.P. Diene justifies himself by distinguishing between the constructive thinkers and the analytic thinker. The former takes an overall view of the goal, works intuitively towards it, does not concern himself with the details in the beginning but may attend to them later on. Such children are at the concrete stage of mental development. The analytic thinker progresses towards the vague goal initially consciously step by step as demanded by the logical requirements within

the system. Children at the formal stage of development exhibit analytic thinking. He emphasizes that majority of children need a lot of constructive activities before they can develop analytic understanding.

J. Bruner, Benjamin, Bloom and J. McHund believe that advances in knowledge takes place when assumptions underlying thought processes are questioned. They state that an individual's achievement in life depends very largely on what he has been helped to learn before the age of four, for that is when human intelligence grows most rapidly and the roots of intellectual curiosity are laid.

Wall has drawn attention of the teachers to distinguish between the logical structures of a subject, process or technique and the psychological mode in which it is taught! If a teacher presents a notice, operation or technique concretely which is found of interest and immediate value by the child, it is quite possible for the child to acquire it at an earlier age than those concepts which are unrelated to his interests and presented in a symbolic abstract or generalized way. The reason offered for this is that even content remaining more or less the same, the underlying psychological processes are entirely different.

J.C. Wallce summarizes the conceptual development - "a definitive answer to the question of the nature of the relationship between the process evoked by training sequences and

those which figure in 'normal' development is still a considerable way off. Taken in conjunction with the only slightly more clear evidence on the question of the authenticity of the changes in performance produced by training, this assessment supports the conclusions that the case against the educational utility of acceleration studies remain to be proved. In the interim, their potential practical contribution in the search for methods sufficient to produce the attainment of particular landmarks in cognitive development appears to mark the continuation of acceleration studies worthwhile.

So, if learning is to be effective then it should be in accordance with the laws of spontaneous cognitive development identified in Piaget's original cross-sectional studies of the to be learnt concepts. Sinclair says that "The subject himself is the mainspring of his development, in that, it is his own activity on the environment or his own active reactions that make progress". The best procedure for training Piagetian concepts are those which imitate processes operating in everyday life. Inhelder, "In terms of successful training prodecure the more active a subject is the more successful his learning is likely to be."

Piaget appears reluctant to make any recommendation to teachers or parents on how to accelerate mental growth and the result of training experiments seem too complex to justify easy generalisations. Numerous inferences have been put

forward by educational psychologists but these are without much experimental support. Children do not build up more advanced concepts just by being told. They have to discover them through their own activity, preferably in collaboration with pears. The acquisition of a new structure or stage depends on matching the environmental stimulation or new experience to already available structures, that is, new experiences should be in advance, but not too much in advance, of the present stage. In addition, the greater the variety of stimulation and practice, the better stabilized a structure becomes and the more transferable it is to other similar situations. This is the essence of the accomodation process. Reliance on verbal instruction is particularly to be depricated, since children can readily acquire and regurgitate, verbal or number concepts and rote skills without understanding them or realizing their transferability to other problems. The building up of effective structures and logical thinking is primarily perceptual and practical, and verbal representation of ideas is secondary. However, such representation facilitates rapid thinking, and thought and language become increasingly interdependent among older children and adults.

A number of experiments have also been carried out to investigate whether children's level or reasoning can be raised from one stage to the next. (Modgil, 1974). The outcome of these studies has generally been to demonstrate

that higher levels of reasoning can be achieved with respect to specific tasks, but that the extent of generalization is limited. Within the context of Piagetian research, the issue has been related to the question about the extent of maturational determinants of development. Where generalization of effect of training has been found, it has been hypothesized that the individuals concerned were, in any case, on the verge of transition to the next level or reasoning. Clearly such an argument can begin to be circular.

Bryant (1974) has suggested that, in some respects, the problematic aspects of the task used to assess, Piaget's level of reasoning reflect the amount of information available to the child, rather than his capacity to make rational use of the information.

Some conditions of upward stage change :

The acceleration of thought is said to have taken place only if there is seen a change from the lower stage of intellectual development to the higher one. The conditions for the change is seen as follows :

1) A predisposition for change, characterized by "stage mixture". How far stage mixture may itself be facilitated, and how far it has to be regarded as a readiness factor, is not known at present.

2) Presentation, in some involving format of views incorporating a structure roughly one stage above that already existing in each subject.

3) Home environment - post convential parents tend to have post convential children. It is not known how far this is explicable in terms of flexible parental control.

4) Different transitions have different conditions of optional change. Such conditions reflect the inherent structure of the particular transition. Transition to post conventionality require opportunities for the exercise for the autonomy.

5) In general, the change process is highly complex and appears to be triggered by different combinations of events in different individuals.

Adolescent Thinking : General Characteristics :

The question that arises is about the experimental thinking of adolescence in situations which impel them towards both actions and thought at the time, from the standpoint of logical structures. This work seems to imply that the thinking of the adolescent differ radically from that of a child. The child develops concrete operations and carries them out on classes, relations or numbers. But their structure never

goes beyond the level of elementary logical groupings or additive and multiplicative numerical groups. During the concrete stage, he comes to utilize both the complementary forms of reversibility (inversion for classes, and numbers, and reciprocity for relations) but he never integrates them into a single total system found in formal logic. In contrast, the adolescent superimposes proportional logic on the logic of classes and relations. Thus, he gradually structures a formal mechanism reaching an equilibrium point at about 14-15 years, which is based on both the lattice structure and the group of four transformations. This new integration allows him to bring inversion and reciprocity together into a single whole. As a result, he comes to control not only hypothetico-deductive reasoning and experimental proof based on the variation of a single factor with the other held constant (all other things being equal) but also a number of operational schemata which he will use repeatedly in experimental and logic mathematical thinking. But there is more of thinking than logic. The structural transformation is like a centre from which radiate the various more visible modifications of thinking taking place in adolescence.

The appearance of formal thought is a manifestation of cerebral transformations due to the maturation of the various systems and these changes do have a relation with puberty. The lattice and group structure are probably isomorphic with

neurological structures and are certainly isomorphic with the structures of the mechanical models devised by cybernetics in imitation of the brain. It seems that the development of formal structures in adolescence is linked to maturation of cerebral structures. The exact linkage is far from simple since the organization of formal structures must depend on the social milieu as well. Moreover, the history of formal structures is linked to the evolution of cultural and collective representations as well as their ontogenetic history. The Greek adults became aware of some of these structures in their logical and mathematical reflections. Thus the age of 11-12 years may be beyond the neurological factors, a product of a progressive acceleration of individual development under the influence of education and perhaps nothing stands in the way of a further reduction of the average age in a more or less distant future.

Hence, far from being a source of fully elaborated "innate ideas" the maturation of the nervous system can do more than determine the totality of possibilities and impossibilities at a given stage. A particular social environment remains indispersable for the realization of those possibilities. If follows that their realization can be accelerated or retarded as a function of cultural and educational conditions. This is why the growth of formal thinking as well as the age at which the individual starts to assume adult roles - remains

dependent on social as much as and more than on neurological factors.

Psychological facts, reject this hypothesis of complete social determinism. Society does not act on growing individuals simply by external pressure and the individual is not, in relation to the social any more than to the physical environment, a simple tabularasa on which social constraint imprints readymade knowledge for if the social milieu is .. really to influence individual brains, they have to be in a state of readiness to assimilate its contributions. So we come back to the need for some degree of maturation of individual cerebral mechanisms.

Two observations arise out of this circular process which characterizes all exchange between the nervous systems and society. The first is that the formal structures are neither innate a priori forms of intelligence which are inscribed in advance in the nervous system, nor are they collective representations which exist ready-made outside and above the individual. Instead they are forms of equilibrium which gradually settle on the systems of exchanges between individuals and the physical milieu and on the system of exchanges between individuals themselves.

The adolescent is the individual who commits himself to possibilities - his commitment begins in real life situa-

tions. In other words, the adolescent is the individual who begins to build "systems" or "theories" in the largest sense of the terms.

The child does not build systems. His spontaneous thinking may be more or less systematic at first only to a small degree, later much more so, but it is the observer who sees the system from outside while the child is not aware of it since he never thinks about his own thought. The child has no powers of reflection, i.e., no second order thoughts which deal critically with his own thinking. No theory can be built without such reflections.

In contrast, the adolescence is able to analyse his own thinking and construct theories. One fact that these theories are over simplified awkward and usually contain very little originality is besides the point from the functional standpoint his systems are significant in that they furnish the cognitive and evaluative bases for the assumption of adult roles, without mentioning a life programme and projects for change.

To explain the adolescent's new capacity to orient himself towards what is abstract and not immediately present is the most direct and moreover the simplest manifestation of formal thinking. Formal thinking is both thinking about thought and a reversal of relations between what is real and what is possible. There are two characteristics in the abstract

language appropriate to the analysis of reasoning. The adolescent's theory construction shows both that he has become capable of reflective thinking and that his thought makes it possible for him to escape the concrete present towards the realm of the abstract and the possible. This does not mean that formal structures are first organised by themsleves and are later applied as adaptive instruments where they prove individually or socially useful. The two processes - structural development and everyday application - both belong to the same reality and it is because formal thinking plays a fundamental role from the functional standpoint that it can attain its general and logical structure. Logic is not isolated from life, it is no more than the expression of operational coordinations essential to action.

The principal intellectual characteristics of adolescence stem directly or indirectly from the development of formal structures. Thus, the latter is the most important event in the thinking found in this period. As far the affective innovations found at the same age, as usual, we find that they are parallel to intellectual transformations, since affectivity can be considered as the energetic force of behaviour whereas its structure defines cognitive functions. The chief characteristics of adolescent thinking from concrete thinking is as follows :

Real Versus Possible :

Piaget has argued convincingly that adolescents and adults tend to differ from children in the way they conveive the relation between 'the Real' and 'the Possible'. The elementary school child is earthbound, concrete, practical minded sort of problem solving approach, one that persistently fixates on the perceptible and inferable reality right there in front of him. His conceptual approach is definitely not unintelligent, much less non-symbolic and it certainly generates solution, attempts that are far more rational and task relevant than anything the preoperational child ever produced. It does, however, hug the ground of detected empirical reality rather closely and speculations about other possibilities, i.e., about other potantial as yet undetected realities, occur only with difficulty and as a last resort.

An adolescent and adult is more likely than an elementary school child, to approach problem quite the other way round, at least when operating at the top of his or her capacity. The child usually begins with reality and moves reluctantly, if at all to possibility, in contrast the adolescent or adult is more apt to begin with possibility and only subsequently proceed to reality. That is he may examine the problem situation carefully and try to determine what all the possible solutions or states of affairs might be, and then systematically try to discover which of these is in fact,

the real one in the present case. For the concrete operational thinker, the realm of abstract possibility is seen as an uncertain and only occasional extension of the safer and surer realm of palpable reality. For the formal operational thinker, on the other hand, reality is seen as that particular portion of the much wider world of possibility which happens to exist or hold true in a given problem situation. Possibility is subordinated to reality in the former case, whereas reality is subordinated to possibility in the latter case.

Empirico-Inductive Versus Hypothetical Deductive :

This subordination of the real to the possible expresses itself in a characteristic method of solving problems. The formal operational thinker inspects the problem data, hypothesizes that such and such a theory or explanation might be the correct one, deduce from it that so and so empirical phenomena ought logically to occur or not occur in reality and then tests his theory by seeing if these predicted phenomena do in fact occur. Because of its heavy trade in hypotheses and logical deduction from hypotheses, it is also called hypothetic deductive reasoning and it contrasts sharply with the much more non-theoritical and non-speculative empirico inductive reasoning of concrete operational thinkers.

This kind of thinking beings with the possible rather than the real in two senses. First, the subject's initial

theory is only one of a number of possible one that he might have concorded. It is itself a possibility rather than a reality and it is also only one possibility among many. Second, the "empirical reality" predicted by or deduced from his initial theory is itself only a possibility, and also only one possibility among many. Actual, concrete reality only enters the scene when the subject tries to verify his theory by looking for the "reality" it has predicted. If it is not found, new theories and new theory derived realities will be invented, and thus the sampling of possibilities continue. These theories and theory derived realities are purely conceptual entities. They are complex objects of thought constructed by a mature, abstract reasoner on the basis of a careful analysis of the problem situation; they are not mere representations of the perceived situation itself.

Intrapropositional Versus Interpropositional :

The child of elementary school age can construct mental, symbolic representations of concrete reality and can also evaluate their empirical validity under many circumstances, for example, if there are some objects in two rows and the object in one row is spread out, he can conclude that the number of objects is still the same. Although the term "propositional" is often applied to formal-operational reasoning to distinguish it from the concrete-operational type, middle childhood subjects can indeed produce, comprehened and

verify propositions. There is, however, an important difference between the two in the way they deal with propositions. The child considers them singly in isolation from one another, testing each in its turn against the relevant empirical data. Since what is confirmed or unconfirmed in each case is but a single claim about the external world, Piaget calls concrete operational thinking "intrapropositional", i.e., thinking within the confines of single proposition. While a formal operational thinker also naturally test individual propositions against reality, he does something more that lends a very special quality to his reasoning. He reasons about the logical relations that hold among two or more propositions, a more subtle and abstract form of reasoning which Piaget terms "interpropositional". The less mature mind looks only to the factual relations to which it refers; the more mature mind looks also or instead to the logical relation between one proposition and another. The individuals initial theory asserts ("proposes") that the logical relation called "conjunction" holds between three propositions, that is, he establishes a logical relation between two sets of propositions, the constituent propositions of each of which he has already knitted together by logical connectives. This is certainly "intrapropositional" thinking in the fullest sense.

Why this kind of reasoning is also called "formal" ? To reason that one proposition "logically implies" (contradicts etc.) another is fundamentally to reason about the realtion between a pair of statements, not about any impirical

phenomena to which these statements might refer. The statements in questions may not be factually correct assertions about the real objects and events in the first place; or indeed they may not even refer to anything at all, real or imaginary. The formal reasoner knows that the experimenter is asking about the logical truths or falsity of pairs of statements as a joint function of what they state (affirmation or negation) and how they are logically linked (conjunction, disjunction); his asking anything about the colour of chips.

The second of the two hypothetical hypothetice-deductive reasoners illustrate a closely related insight, namely, that one does not have to believe something is either true or just, in order to argue for it (although it sure helps). Formal operational thinker understands that logical arguments have a disembodied and passionless life of their own, at least in principle. Concrete-operational thinkers have enough trouble seeing what logically follows from credible premises, let alone from premises that actually contradict one's knowledge, belief, or value.

Finally, formal-operational reasoning is an abstract, derivative-type of mentation by virtue of its interpropositional nature, in that it entails thinking about propositions rather than about reality directly. As Piaget puts it, concrete operations are "first degree" operations that deal with the real objects and events, formal operations are "second

degree" operations that deal with the propositions or statements produced by the first degree, concrete ones. Another way to conceptualize it is to say that formal operations constitute a kind of "metathinking", i.e., thinking about thinking itself rather than about objects of thinking. Children certainly are not wholly incapable of this and other forms of "metacognition" e.g., thinking about other psychological processes such as language, perception, and memory (Flavell and Wellman, 1976; Kreatzer, Leonard, and Flavell, 1975).They are not as able to engage in it as adolescents and adults.

Combinations and Permutations :

One difference between concrete-operational and formal-operational reasons that Piaget makes much of is the latter's superior ability to make a systematic combinatorial analysis of a set of elements (variables, propositions or whatever). That is the mature thinker is more likely able to construct a systematic, efficient method for generating all the possible combinations (and also permutations) of a set of elements. His ability to be correspondingly planned and orderly about generating all possible permutations could be tested by seeing how he sets about trying to generate all the different license numbers that can be made up from rearrangements of the numbers 1, 2, 3 and 4 (Leskow and Smock, 1970; Martorano, 1974; Neimark 1975 b).

Piaget believes that the ability to generate all possible combinations, in particular, is especially important in solving scientific, control of variable type problems (e.g., Inhelder and Piaget, 1958, Chap.7). The reason is that the solver has to determine exactly the results. If he had no systematic method of generating all possible combinations, he might fail to think of some and would therefore,fail to test their effects.

Inversion and Compensation :

Another adolescent adult cognitive achievement emphasized by Piaget is the ability to integrate the two forms of reversible thinking - inversion and compensation (or reciprocal, as the latter is so often called).

Piaget believes that the middle childhood subject is largely limited to use the inversion form of reservibility in certain task situations and the compensation reciprocal form in different ones.. In contrast, the adolescent and adult can apply them both to the same problem, and more importantly, can also appreciate the dynamic structure or system that they and their two opposite (i.e., direct) operations jointly constitute. In the balance problem and in number of others, there are two distinct ways to produce an effect and also two distinct ways to counteract it. Inversion and compensation-reciprocal operations figure very important in Piaget's mathematical-logical theoritical models of concrete operational thought. The dya-

namic system which they and their opposite constitute together with the earlier mentioned combinatorial system and some propositional logic, play a similarly crucial role in this theoritical model of formal operational thought (Flavell,1963, Chapts. 5 and 6).

Information Processing Strategies :

This category of development changes has considerably overlap with the preceeding ones and also is very difficult to characterize in a simple and precise way (Nemark, 197, 1975a). When adolescents and adults attempt to deal with problems or tasks of a wide variety of types, they are generally apt to be more planful, strategic and efficient than children in their organisation and manipulations of the available information. The difference between older and younger individuals is not by any means absolute and naturally vary with the problems and individuals considered. There is an important trend here, nevertheless. This trend is very apparent in the more flexible, task-adaptive way older subjects deploy their attentions, organize the task data for easier learning and better subsequent recall, and otherwise deal effectively with the situation. With respect to "problem solving" in the narrow and more traditional sense. It is essential to watch how individuals of different development levels attempt to solve "Twenty Question" type problems when asked to do so as efficiently as possible, i.e., using the least possible

questions. (Bruner, Olver and Greenfield, 1966; Nelson and Earl, 1973). Adolescents and adults are more likely than children to adopt a systematic question-asking strategy that is very efficient, and also very "strategic" in its abstract circumlocutions clearly planful quality. This strategy consists in asking a series of increasingly constraining categorical questions, with each subsequent question carefully selected on the basis of the yes or no answer given to its predecessor.

Consolidation and Solidification :

It certainly seems reasonable to assume that the sensory motor skills and knowledge acquired during infancy become further consolidated and solidified during the post infancy years. It seems equally plausible that the same thing may happen to middle childhood cognitive acquisition. The attainments become "further consolidated and solidified" during adolescence and early childhood, might mean that they are progressively integrated into more and larger networks or structures of knowledge, thereby becoming related to an ever greater number of other concepts, beliefs, skills, etc. It might also mean that, should the adolescent or adult have occasion to think about something that had originally been acquired during middle childhood, he now would be capable of thinking about it in a formal operational as well as a concrete operational way. The outcome might be for instance,

new and deeper justifications for a belief that had earlier been more minimally justified, if ever explicitly rationalized at all.

These two interpretations of "further consolidated and solidified" are not really very different. Under both interpretations, a concrete operational attainment is presumed to undergo some sort of change in its relation to the rest of the cognitive system. It does so because the rest of the cognitive system - it's "internal environment" so to speak, has itself undergone developmental change as the individual approaches intellectual maturity. Since concrete operational attainments will continue to be useful and valid adaptions to reality in adulthood as in childhood, we may assume that the above mentioned change in relation does indeed have a consolidating and solidifying effect on them. Additional maturation and experience should fix them more firmly in the subjects cognitive system and consequently should make them more resistant than they initially were to any attempt to alter or extinguish them.

Concrete Operational Thinking :

The stage of concrete operations begins at about the age of 7 or 8 (Piaget and Inhelder, 1969). Operations are essentially groupings of schemes. They are called operations when the grouping have special interrelationship.

The Origin of Concrete Logic :

Piaget believes such operational principles grow out of the individual's own actions and experiences. During the course of many experiences, a child develops certain basic rules of thinking logically. One such rule is that an idea can be the same in different forms.

Principles of Concrete Logic :

There are four principles that Piaget believes to characterize operational thought. Before systems of actions carried out in the mind (i.e., systems of operations) can be stable, they must according to Piaget, have certain properties; unless these are present, thought will show inconsitencies. These properties are :-

1) Closure : Any two operations can be combined to form a third operation, e.g., all boys and all girls equal all children.

2) Reversibility : For any operation there is an opposite operation which cancels it, e.g., all boys plus all girls equal all children, but all children except all boys equal all girls.

3) Associativity : When three operations are combined it does not matter which two are combined first or the same goal can be reached by different routes, e.g., all adults plus all boys and girls equal all boys plus all girls and adults.

4) Identity : This is a null operation and is performed when any operation is combined with its opposite, e.g., all human beings except all those who are human beings equal no body.

Controlled Experimentation :

Inhelder and Piaget contend that the ability to properly control variables develops during the stage of formal operations because it requires an ability to form combinations and use proportional logic. For correctly controlling variables, one should be able to use the mental schemata of "all things being equal" in other words a test of 'understanding' of the logic necessity for keeping all factors const-ant except the one whose effect the child was attempting to answer. The ability to control variables, to keep all but one variable the same so the effect of the variables that is changed can be investigated is relevant to many everyday decisions.

The procedure of controlled experimentation unifies those attitudes and actions that permit one to critically judge and direct experiences, rather than be led by it. As an ideal for the controlled experimentation,(i.e., valid comparison, fair test, empirical varification) serves not only in physical science but in all endeavour where hypotheses and evidence are to be evaluated. Devery and Piaget have accorded special status to the notion of empirical verification while contemporary educators are concerned with the process of attainment of this procedure.

Numerous investigators (using Piaget's formal stage criteria) have found that the procedure is lacking in about 50% of the adult population. Moreover, Piaget's evidence and his theory lead to the conclusion that a proper notion of verification or proof is beyond the logical competence of the majority of people prior to about 14-15 years, increasingly so at younger ages. Since Piaget holds that maturational factors constraint the pace of intellectual development, it is widely conjectured that short term teaching can do little to substantially faster his development.

Contrary to what Piaget leads many to expect, there exists among elementary school pupils a sound intuitive understanding of a fair test. However, this limited intuition does not usually develop spontaneously into a clear generally applicable procedure as witnessed by the numerous studies of adolescents and adults. By attempting to teach the procedure of a controlled exoerimentation it is hoped to discover obstacles to attainment and ways to overcome them.

In the present study two schemes of thoughts have been chosen for pre-test and post-test. They are the separation of variable and the exclusion of variable. These two schemes of thought follow the criteria of controlled experimentation laid down by Piaget. The former scheme of thought involves the strategy of experimenting with one vital variable by keeping other variables constant or in other words, using 'all the

variables constant but one' technique. The latter scheme of thought involves the isolating strategy that is one by one the irrelevant variables are excluded. For the excluding technique again, controlled experimentation plays its role. That is, all the possible variables are controlled by keeping all but one variable constant. This controlling helps the student to pick up and point out the causative variable. Thus, separating it from the irrelevant one.

Nature of Experimental Control Used Outside the Experiment to Prepare the Matched Groups:

This study proposes to determine the effect of training on more or less a homogenous group. To bring about this, control outside the experiment was also taken into consideration, that is, matching the groups against intelligence and socio-economic status across age and grade.

The word 'control' implies that the experimenter has a certain power over the conditions of his experiments, he is able to manipulate variables in an effort to arrive at a sound conclusion. In any controlled experimentation, there are two variables which are acting, namely, the independent variables and the extraneous variables. Extraneous variables are those that are operating in the experimental situation in addition to the independent variables. The extraneous variable may affect the dependent variable so it must be regulated in such a way that it may not mask the effect of the independent variable.

Failing to control extraneous variables result in a confounded experiment, i.e., if an extraneous variable is allowed to operate in an uncontrolled manner, and the independent variables are confounded (the dependent variable is not free from irrelevant influences). Confounding occures when there is an extraneous variables that is systematically related to the independent variable and it may act on the dependent variable, hence the extraneous variable may effect the dependent variable scores of one group but not the other. If confounding is present, then any change that occures in the dependent variable cannot be ascribed to the independent variable. So, confounding occurs when an extraneous variable is systematically related to the dependent variable and it might differentially affect the dependent variable sources of the two groups.

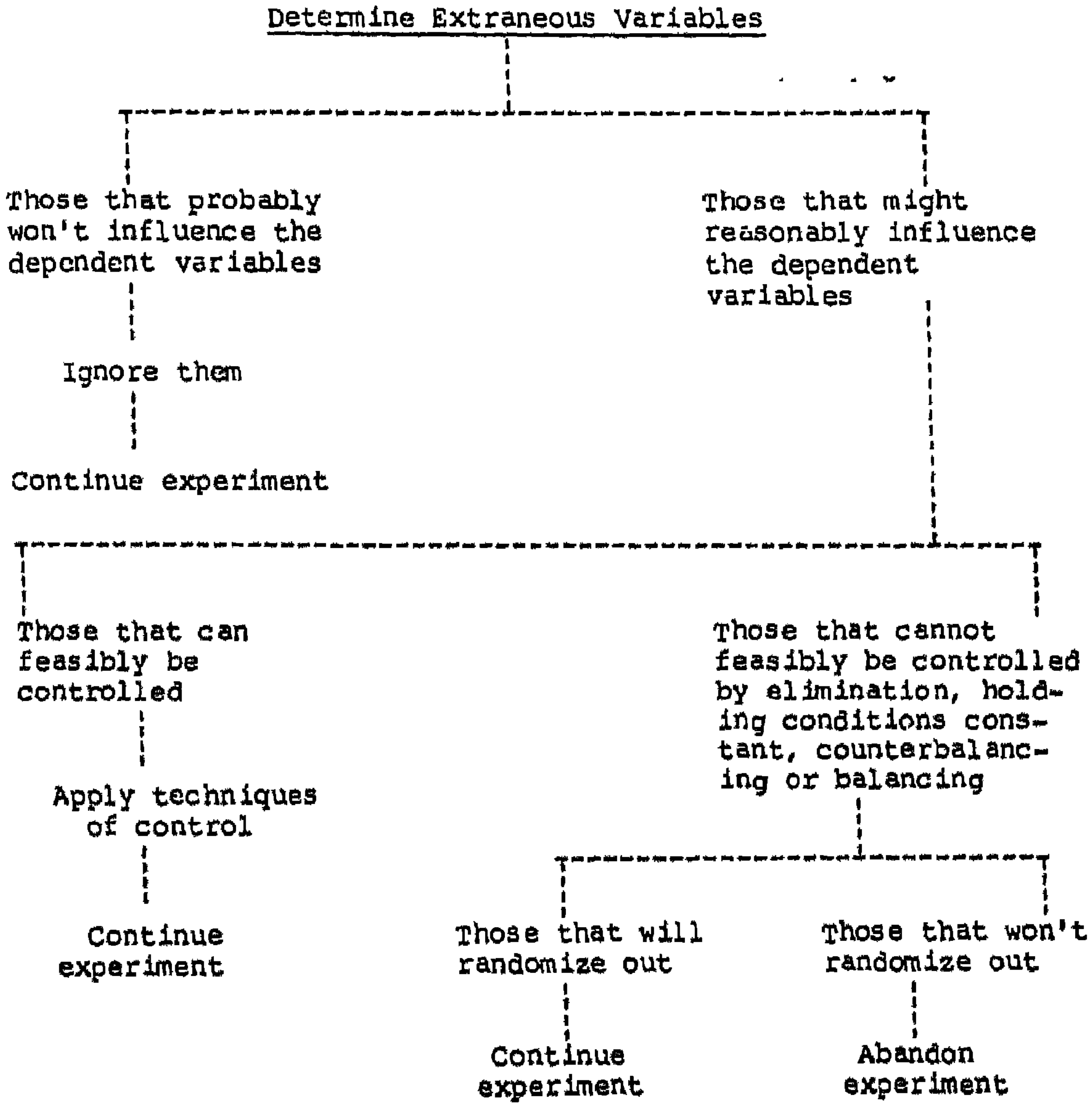
Experimental control, then, is the regulation of experimental variables. There are two classes of experimental variables; independent and extraneous. The independent variables are those whose effect the experimenter is attempting to determine. He wants to know if a given independent variable affecting his dependent variable. The extraneous variables or dependent variables are all other variables operating on the subjects at the time of the experiment. By exercising independent variable control the experiments vary the independent variables as he wishes. By exercising extraneous

variables control, he regulates the extraneous variables, so that confounding is eliminated. If adequate extraneous variable control is exercised, an unambiguous statement on the relationship between the independent and dependent variable can be made. If extraneous variables control is inadequate, however, the conclusion may be tempered. The extent to which it may be tempered depends on a number of factors, but generally, inadequate extraneous variables control leads to no conclusion, whatsoever, concerning the relationship.

Determining Extraneous Variable :

In order to control the experimental situation it is first necessary to identify the extraneous variables. The extraneous variables may be endless. So, only those extraneous variables which might conceivably affect our dependent variable should be taken into consideration. These can be made easy by determining from the related literature, survey, previous experiments, etc.

According to F.J. McGuigan (138) after the independent and dependent variables are determined, the experiment to be conducted can be planned on the basis of the following steps:


Determine Extraneous Variables
Those that probably won't influence the dependent variables
Ignore them
Continue experiment
Those that might reasonably influence the dependent variables
Those that can feasibly be controlled
Apply techniques of control
Continue experiment
Those that cannot feasibly be controlled by elimination, holding conditions constant, counterbalancing or balancing
Those that will randomize out
Continue experiment
Those that won't randomize out
Abandon experiment

PIAGETIAN THEORY - SOME BASIC IDEAS :

The work of Jean Piaget mainly concerned with the insight into the mental functioning of children has attracted world wide attention, recently. Piaget very carefully traces the growth of mental development right from early childhood

to late adolescence. He has described the intellectual development of children in a series of consecutive stages. Before describing the stages it is important to know Piaget's view on intelligence and what is intellectual development.

Piaget's concept of intelligence :

Several definitions of intelligence are offered by Piaget. His definitions of intelligence is not restrictive but states that :

(a) "..... intelligence is a particular instance of biological adaption..." thereby, meaning that human intelligence is one kind of biological achievement, which allows the individual to interact effectively with the environment at a psychological level.

(b) "Intelligence is the form of equilibrium towards which all the cognitive structures ..... tend". Equilibrium implies to a balance, harmonious adjustment between at least two factors. In this case between the environment and an individual's mental structure. The environment may cause a disturbance in the equilibrium, but the individual performs mental actions which gradually restore the balance.

(c) Intelligence is "a system of living and acting operation". An individual is a biological organism who interacts with

the world through mental activities.
These interactions are carried on in a
logical sequence.

Piaget regards intelligence as a specific instance of adaptive behaviour, of coping with environment and organising (and reorganising) thought and action. Adaptation begins with the random diffuse mass reflexes and the neonate state and progresses by stages to the formal, logical reasoning of adulthood. The transitions from one stage to another are gradual and result from continuous creative activity of the child and interaction between him, and his environment. At each stage, child's knowledge and understanding of the world (his "mental structure" or "organisation" in Piaget's term) expand. Reorganisation of information and the development of new capabilities make possible to manifest more complex type of intelligent behaviour, thinking and reasoning. The reflexes of the new born become transformed through a series of differentiations and coordinations into the latical 'organisation" of adult intelligence. With development, a child becomes capable of taking into account more stimuli, and of employing more complex techniques of solving problems.

Generally, his theory may be viewed as having three interdependent and interwoven aspects. First, a structural aspect represents the focal point of Piaget's continuing interest, that is, the inferred psychological structure of intelligence which underlie observed behaviours. Second, a

stage aspect provides the context of framework for the sequential development of the psychological structures. And finally, a functional aspect provides the primary explanatory construct with explicate the functioning and development of structure in terms of principles of adaptation.

The Cognitive Structure :

The organizational pattern of behaviour are referred to as mental structure. The organism comprehends the world through these structures and their nature. There is an organised coherent pattern of action or generalised behaviour which maintains an identity across time, objects, settings and specific hevaviour. It refers to the systematic properties of an event, it encompasses all aspects of an act, both external and internal. Cognitive structures are underlying variables that control intelligence at any given level of development. They undergo both quantitative and qualitative changes during development. Actually cognitive development is essentially synonymous, with changes in cognitive structures. Cognitive structures are very abstract and cannot be directly measured. Since cognitive structures cannot be measured, we are confined to construct from logic to mathematics. The mechanism whereby structure change takes place is called equilibrium process. Equilibration produces new structures that are more general in scope and more stable than previous ones.

The Schema :

Structural units in Piaget's system are called schemes or schemata plural of schema. They form a kind of framework into which incomming sensory data can fit. Thus it is a framework that continually changes its shape to assimilate these data.

The schema, generally, includes a variety of acts in many different circumstances not just a response to a specific stimulus. It is also different from the response to a stimulus as it is mobile and the mobility increases with age. By mobility of a schema, Piaget means that it can be applied to a variety of objects even if the objects were never encountered before. Mobility of schema, according to Piaget, increases when action becomes instrumental, that is, when it is employed as a means for obtaining some goal in addition to being an action that functions as an end in itself. The child's behaviour is much more adaptable when he can grasp objects, pull them aside and then release them in order to get what ever lies behind them.

The schemata that involve overt actions are called sensory motor schemata but when the laws of logic or the concept of space or number system are involved they are said to be cognitive schemata. Piaget put the sensory motor schemata under the same lable as cognitive schema because cognitive processes are best conceptualized as actions. For another

reason he believes that cognitive schema derive from sensory motor schema by a process of internalization. For him, thinking certainly involves internalized use of language, although he does not mean that thinking is nothing but subvocal speech. Conceptual thinking to him also involves such mental acts as adding, drawing implication or judging distances.When these internal actions become integrated into coherent logical system they are considered logical operations and the child who employs such system of operations is said to be at the stage of concrete or formal operations.

Cognitive Functions :

Piaget points that intelligence has certain 'invariant functions' or general characteristic and having made this assumption he searches for the means or structures which serves, these functions. The general functions which Piaget proposes are organisation and adaptation. These are the most important cognitive functions. These two functions operate in the same manner throughout the life span and hence are called functional invariants. They are biologically inherited modes of interacting with environment. Perhaps the most important thing about organization is that it implies that intelligence is an integrated whole rather than collection of isolated behaviours. With references to intelligence,these inherited "functional invariants" impose certain necessary and irreducible conditions on structural organisation and are

responsible for the organisms cognitive continuity across time, where as adaptation is responsible for cognitive change. The schema is the element of structure that adapts. The process of adaptation is described by a twin concept of assimilation and accomodation. These concepts show that the behaviourial patterns are sometimes adequate to cope with a problem and other times are in need of modification to become effective. They also indicate that an invididual is attracted to problems that stretch his adaptation and he feeds upon such challenges to grow in behavorial effectiveness.

Intelligence is itself conceptualised as adaptation to the social and physical environment. Thus, it is not the case that intelligence leads to adaptation, but rather adaptive behaviour is intelligent behaviour. In a general sense adaptation may be viewed as the process whereby as the result of an act upon the environment, the organism is changed in a manner which benefit its further survival. Thus, the adaptation serves to focus for the activity of the child whether external (behaviour) or internal (structures) which facilitates further interactions with the environment.

While adaptation represents the external environmentally direct aspect of intelligent functioning, organisation represents its external aspect. Although organisation is always present, the form of the organisation (structure) changes as a result of progressive adaptation. Thus structure changes through the activity involved in adaptation.

Cognitive Contents :

Cognitive contents are the general acts of intelligence that characterize a given stage of development. Concepts are all cognitive contents less central to theory than structures or functions but it is not possible for the theory to get along without them. Since neither structure nor functions are amenable to measurements, their presence is inferred from the presence of cognitive contents.

Operations :

The concept of operation is probably the most unique feature of Piaget's theory. Operations have four defining characteristics. First, they are symbolic representation. Second, they originate from motor activity. Third, they obey certain logical rules, especially the reversibility rules of inversion and comprehensation. Fourth, they always gather together in tight systems called structures of the whole.

Assimilation and Accommodation :

Piaget views human cognition as a specific form of biological adaptation of a complex organism to a complex environment. According to him the man's activity selects and interprets environmental information in the construction of his own knowledge rather than passively copying the information just as it is presented to his senses. But, he is always reconstructing and reinterpreting the einvironment in

accordance with his own existing mental framework. The mind is not passive to the world, but builds its knowledge structures by taking external data and interpreting them, transforming them and reorganising them. It, therefore, does meet with the environment in the process of constructing its knowledge and consequently that knowledge is to a degree 'realistic' or adaptive for the organism.

Cognition, like other forms of biological adaptation, always exhibits two simultaneousand complementary aspects, which Piaget termed as assimilation and accommodation. Piaget conceives them as two indissociable aspects of the same basic adaptational process, two sides of the cognitive coin. Assimilation essentially means interpreting or constructing external objects and events in terms of one's own presently available and favoured ways of thinking about things. Accommodation roughly means noticing and taking cognitive account of the various real properties and relationship among properties that external objects and events possess. It means the mental apprehension of the structural attributes of environmental data. Assimilation, therefore, refers to the process of adapting external stimuli to one's own internal mental structure, while accommodation refers to the converse or complementary process of adapting these mental structures to the structures of these same stimuli. In cognitive adaptations individuals simultaneously accomodate to the particular struc-

ture of the object of their cognitions and assimilate that object to their own cognitive structure.

Therefore, according to Piaget, in any cognitive encounter with the environment, assimilation and accommodation are of equal importance and must always occur together in a mutually dependent way. His model of the human cogntive system stresses the constant interaction or collaboration of the internal cognitive with the external environment in the construction and development of knowledge with both factors making a vital contribution to this construction and development. What is already known will gently shape and constrain the environmental information that can be detected and processed which provide essential grist for the activation of present knowledge and the generation of new knowledge.

Assimilation and accommodation, are the constituent activities of the general function of adaptation, and as such they form the explanatory basis of how structure changes. In general, structures change through the assimilative activity of incorporating objects into ongoing schemata and the accommodative activity of modifying the schemata to new schemata.

Equilibrium :

The equilibration theory is of great importance to mental development. Twith writes, "the essential point in

the 'knowing circle' is internal structure. The circle assimilates or incorporates the real event into the structure and at the same time accommodates the structure to the particular feature of the real event." The organism tends to organize structures into coherent and stable patterns. His ways of dealing with various situations tend towards a certain balance. He tries to develop structures which are effective in his interaction with reality. When a new event occurs, he can apply to it the lessons of the past (or assimilate the events into already existing structures), and he will easily modify his current patterns of behaviour to respond to the requirements of the new situations. With increasing experience he acquires more and more structures and, therefore, adapts more readily to an increasing number of situations.

Grouping of Thought :

Piaget placed great emphasis upon the child's achievement on certain sets of interrelated intellectual actions which have the properties of a group, and may be called grouping of thought. Piaget borrowed this concept from mathematics where it has specific meaning. The grouping of thought is closely related to the notion of equilibrium.

In mathematics, a group is a set of elements whose relations with one another have certain properties. Piaget usually considers the elements as certain logical or numerical

operations such as the operations of combining two classes of objects into a single class or the operation of adding two numbers.

Every set of elements does not form a group. For the set to be a group, there are some laws of combination of elements. Ordinarily this operation is given the general label multiplication but it is not similar to the multiplication in arithmatic. According to Baldwin, a set of elements from a group under some specified law of combination, if :-

1) There is a law of combination that applies to every pair of element in the set, and the result of that combination is in every case a member of the set. This is criterion of closure.

2) Any combination of three or more elements is associative.

3) There is an identity element whose combination with any element leaves it unchanged.

4) Each element has an inverse element in that set such that the combination of anelement and its inverse is the identity element.

Piagetian grouping of thought as postulated by Sandhu:

1) The first postulate expresses the possibility of coordinating operations 'grouping of thought', i.e.,

two distinct classes may be combined into one comprehensive class which embraces them both.

2) In Piagetian 'grouping of thought' the concept of associativity, i.e., the second postulate expresses the fact that the child can combine classes in different orders and can realize that the results are equivalent.

3) The third postulate i.e., identity status that there is a special element in the system (the nothing element) which when combined with any of the other elements produces no change.

4) The fourth postulate is reversibility. This type of operation expresses the aspect of class inclusion.

5) The fifth property of 'grouping of though' is unique. It has several aspects. One of them has to do with special identity element. Another aspect is resorption. In a way, this is just like looking at inclusion relation.

Piagetian 'stages' of development :

A stage in the development of intelligent behaviour may be defined as the totality of behaviour similar in function in its dependence on the environment. In Piaget's terms, a stage is identified not by quantitative measurement but by qualitative characteristics. These identifying qualitative

characteristics relate to structural changes in cognitive organization. The cognitive stages have a sequential property, that is, they appear in a fixed order of succession because each of them is necessary for the formation of the following one. In this way, Piaget identifies four stages. Wohlwill (1966) has sounded a note of caution against attempting to make an absolute demarcation between stages. He argues that the completion of one stage and transition into the next higher stage varies according to the type of problem or subject matter, which the organism faces. But, it is agreed that one stage gradually merges into the higher one. The characteristics of that higher stage develop slowly but firmly till they become distinct. In this way a chain is formed between one stage and another.

Table No.1

The Distinguishing Characteristics of Stages

Sl. No.	Stages	Age Range	Characteristics
1	2	3	4
1.	Sensory Motor period	0-2 Yrs.	- Child is born with reflexes and reflex like behaviour, thus making interaction with the environment possible. - Such developing behaviour are modified by experience, which are, logically speaking, explicable increasingly.

Contd....

1	2	3	4
			- Curiosity appears when there is a discrepancy between the new experience and the past experience.
			- Appears to throw whole of himself physically in the activity. Performs only overt activities.
			- He is attracted by sound, touch and other physical stimuli, while crawling he is on a voyage of discovery. He thinks least of his actions.
			- Action becomes gradually intentional. Object concept develops. He is highly dependent upon his parents for satisfaction of his physical needs.
			- Develops language prominently towards the closing end of this stage which was really not there.
2.	Pre-operational or pre-logical stage	2-7 Yrs.	- Sees things in his own frame of reference.
			- Can think of only one idea at a time.
			- Shows the following three modes of reasoning, viz., simple memory for past experience, desire for

Contd...

1	2	3	4
			discort thinking and reasoning from particular to particular at the cost of underlying unity. Attempts to use abbreviated, visual image, symbols and motor sequences for activities and events. - He cares for mutual communication. - Feels difficulty in expressing his thought hence uses language in a limited way. - Although performance is highly rigid and narrow, use of logical tasks definitely facilitates thinking. - His social interest begin to widen and he tends to become less and less self-centered. - Cognitive growth takes place when attempts are made to reconcile cognitive conflict.
3.	Concrete operational stage	7-11 Yrs.	- Thinking is tied to the concrete situations. Takes care of complex classification and conservation of number, length, quantity, weight and area.

Contd....

1	2	3	4
			- Does not accept hypothetical data, that is, cannot react to abstract situations. Reality dominates possibility and possibility is subordinated to it. - Controlled experimentation is conspicuous by its absence. - Thinking takes gradually a more socio-centric character.
4.	Formal operational period	11-15 Yrs.	- Thinking is no longer tied to the concrete situation. - Possibilities as well as idealism dominates thinking. Now are imagined and considered all sorts of facts, concepts, hypotheses and tentative stabs. - Ability to set up as well as test hypotheses appears markedly. The essence underlying controlled experimental is grasped. Thus the individual minds of adolescent pupils begin to become experimental. - Contradictions as well as paradoxes begin to receive attention for resolution in a wider context. Deductive experimentation become possible.

Contd...

.	2	3	4
			- Reflection on reflection appears for added clarity. Even assumptions are not spared. - Thought continues to move ahead. With the passage of time, equilibrium at higher levels are sought. - Form rather than the content of the problem is found to be increasingly grasped. - Action becomes the basis of knowledge.

It has been observed that while solving a problem, a child is at times in the 'in between stage'. He has passed through a lower stage completely. So he should be at the higher stage now. But, this may not be so. He may be slowly merging into the higher stage but the characteristics of the higher stage may be absent in partial form, and hence, to categories the child into a higher stage will not be very correct. This gap between the lower stage and the higher stage may be termed as transitional period. The present study probes into this period and has been termed as the transitional level.

OBJECTIVES OF THE STUDY:

Educators have been interested in Jean Piaget's theory of cognitive development as a means of linking developmental level concepts that can be grouped under instructional strategy. Also considerable effort has been directed to the acceleration of the child's developmental level. The present study draws its inspiration from the Geneva School. The main aims kept in view are :

1. To determine the status of thought at the three levels of intellectual development, namely, concrete, transitional and formal, using a suitable test among certain groups of adolescent pupils matched on intelligence, age, grade and socio-economic status.

2. To study the effect of 'training' on intellectual development at the above mentioned three levels of intellectual development as broadly propounded by Piaget.

3. To determine the personality characteristics of those pupils who are favourably influenced by training.

4. To determine the influence of training sex wise, age wise, and grade wise.

5. To determine the effect of types of presentation during training.

6. To find out the progress of the subjects through the three training sessions.

7. To determine the difference in mathematical structures of thought, intelligence and personality traits in respect of experimental

8. To point out main educational implication, if any.

HYPOTHESES :

Keeping in mind the nature of the study, the following hypotheses are framed :

1. There is no significant differences between the scores of Pretest and Posttest of control and experimental group at the three levels of intellectual development, sex wise, grade wise and age wise.

2. There is no significant differences in scores during the three training sessions.

3. There is no significant differences in the different mode of presentation of the problems.

4. There is no significant relationship between intelligence and performance of control and experimental group at the Pretest and Posttest grade wise, sex wise and age wise.

5. There is no significant relationship between personality traits and Pretest, Post-test scores of control and experimental group.

6. There is no significant relationship between the personality scores, intelligence and Post-test scores for those students who are favourably influenced by training.

7. There is no strong factorial or mathematical structure underlying the measures of intelligence, various scheme of thought and personality traits with respect to those students showing a favourable influence of training.

DELIMITATIONS OF THE STUDY :

The present study is delimited with regards to the following :

i) Only adolescent pupils from 7th to 10th grade between the age group of 11+ to 14+ are included.

ii) While considering the matched groupings, students of approximately similar socio-economic status,

intelligence, age and grade between the control and experimental group are selected for the study. Thus, students not coming within the range have not being taken into consideration.

iii) Out of various scheme of thought, only two were taken into consideration, namely, separation and control of variables and exclusion of variables.

iv) The sample is chosen from a few local schools of Udaipur. They are -

(a) St.Paul's Boys Higher Secondary School

(b) St.Mary's Girls Higher Secondary School

(c) St.Teressa Ashram Girls Higher Secondary School.

CHAPTER - II

REVIEW OF THE RELATED LITERATURE

INTRODUCTION :

Education have been interested in Jean Piaget's Theory of Cognitive development as a means of linking developmental levels, concepts that can be grouped and instructional strategies. Also considerable effort has been directed towards acceleration of the child's developmental levels. Many researchers, wishing to generalize large numbers have turned away from Piaget's technique to group paper and pencil tests.

Since early 1950's, it has become increasingly clear to the child psychologists, educators and others in diverse areas that Jean Piaget is the foremost contributor to the field of intellectual development. Piaget's work has led to the descriptive analysis of basic, physical, logical, mathematical and moral concept of the individual from birth to adolescence. Now and then work has also been done on the effect of training. In the last decade the interesting question "Can learning be accelerated ?" has been the abiding theme in the area of cognitive development. The present study deals with controlled experimentation, that which tries to unify those attitudes and actions that permit one to critically judge and direct experiences rather than be led by it. The investigator referred to many studies which were in some way related to the present study. These studies have been shown chronologically (Table Nos.2, 3, 4 and 5) along with the type of influence which ultimately resulted.

Table No. 2

TRAINING STUDIES

Sl. No.	Name of author(s)	Year	Title of the studies	Type of influence
1	2	3	4	5
1.	Mumford, S.C.	1937	Factors Involved in Problem Solving with Special Reference to the Problem of Insight.	Positive
2.	Banks, S.H.	1958	How Pupils in a Secondary Modern Schools Induce Scientific Principles from Science Experiment.	Positive
3.	Devane, J.R. and Rimoldi, H.J.A.	1961	Training in Problem Solving	Positive
4.	McDonald, F.H. and Shockley, W.	1964	Teaching Scientific Thinking at High School Level.	Positive
5.	Lunzer, E.A. and Coombes	1969	Teaching for Formal Reasoning.	Positive
6.	Simcex, N.M.	1970	Improvement in the Logic of Eight Year Old Children	Positive

Contd...

1	2	3	4	5
7.	Brainerd, C.J. and Allen, T.W.	1971(a)	Training and Generalization of Density Conservation; Effect of Feed Back and Consecutive Similar Stimuli.	Positive
8.	Brainerd, C.J.	1971	The Development of the Proportionality Scheme in Children and Adolescents.	Positive
9.	Shavelson, R.J.	1971	Some Aspects of the Relationship Between Content Structure and Cognitive Structure in Physics Instruction.	Positive
10.	Wason, P.C. and Shaprio, D.	1971	Natural and Contrived Experience in a Reasoning Problem	Positive
11.	Bass, J. and Montague, E.	1972	Piaget-based Sequence of Instruction in Science	Positive
12.	Quinn, M.E.	1972	Hypothesis Formation Can be Taught.	Positive
13.	Tomlinson, K.C.	1972	Formal Operations in Females from Eleven to Fifty-Four Years of Age.	Positive

Contd....

1	2	3	4	5
14.	Wiegand, V.K.	1972	A Study of Subordinate Skills in Science Problem Solving.	Positive
15.	Case, R. and Fry, C.	1973	Evaluation of an Attempt to Teach Scientific Inquiry and Criticism in a Working Class High School.	Positive
16.	Larone, W.H.	1973	Development of the Combinatorial Scheme in Students Through Experimental Problem Situation.	Positive
17.	Kimball	1973	The Teaching and Understanding of Formal Operations.	Positive
18.	Renner, J.W. and Lawson, A.E.	1973	Promoting Intellectual Development Through Science Teaching.	Positive
19.	Siegler, R.S., Liebart, D.E. and Liebart, R.M.	1973	Inhelder and Piaget's Pendulum Problem; Teaching Preadolescents to Act as Scientist.	Positive
20.	Talisayon, V.M.	1973	Some Cognitive Variables in Meaningful Learning of the Physics Concepts of Work and Energy.	Positive

Contd....

1	2	3	4	5
21.	Gutchfield, M.A.	1974	Conservation Training and School Readiness.	Positive
22.	Gecslin, W.E.	1974	An Analysis of Content Structure and Cognitive Structure in the Control of a Probability Unit.	Positive
23.	Inhelder, B., Sinclair, H and Bovet, M.	1974	Verbal Training Procedure of Conservation of Continuous Quantities.	Positive
24.	Inhelder, B., Sinclair, H. and Bovet, M.	1974	Class Inclusion Training and Its Influence on Conservation.	Positive
25.	Lawsen, A.E., Narland, G.H. and Devito, A.	1974	Piagetian Formal Operational Tasks: A Crossover Study of Learning Effect and Reliability.	Positive
26.	Berzonsky, M.D., Lombardo, T.P. and Ondrako, M.A.	1975	Changes in Logical Thinking as a Function of Induced Disequilibrium.	Positive
27.	Lawson, A.E., Blake, A.J.D. and Nordland, F.H.	1975	Training Effects and Generalization of the Ability to Control Variables in High School Biology Students.	Positive

Contd....

1	2	3	4	5
28.	Linn, M.C. and Thier, H.D.	1975	The Effect of Experimental Science on the Development of Logical Thinking in Children.	Positive
29. ✓	Seigler, R.S. and Liebert, R.M.	1975	Acquisition of Formal Scientific Reasoning by Ten and Thirteen Year Olds. Redesigning and Factorial Experiment.	Positive
30.	Arons, A.B.	1976	Cultivating the Capacity for Formal Reasoning Objectives and Procedures in Introductory Physical Science Course.	Positive
31.	Herbig, M.	1976	Item Analysis by Use in Pre-tests and Post-tests : A Comparison of Different Coefficients.	Positive
32.	Kuhn, D. and Angelev, J.	1976	An Experimental Study of the Formal Operational Thought.	Positive
33.	Renner, J.W.	1976	Scientific Physics Content and Intellectual Development - Cognitive Development as a Result of Interacting with Physics Content.	Positive

Contd....

1	2	3	4	5
34.	Howe, A.C. and Mierzwa, J.	1977	Promoting the Development of Logical Thinking in the Classroom.	Positive
35.	Kurtz, B. and Karplus, R.	1977	Intellectual Development Beyond Elementary School VII : Teaching for Proportional Reasoning.	Positive
36.	Linn, M.C.	1977	Scientific Reasoning : Influences on Task Performance and Response Categorization.	Positive
37.	Linn, M.C., Chen, B., and Thier, H.D.	1977	Teaching Children to Control Variables : Investigation of a Free Choice Environment.	Positive
38.	Peterson, K.D.	1977	An Experimental Evaluation of Science Inquiry Training Program for High School Students.	Positive
39.	Rastovae, J.J.	1977	The Effect of Instructional Mode on School Achievement of Concrete and Formal Operational Students.	Positive

Contd....

1	2	3	4	5
40.	Rowell, J.A. and Dawson, C.J.	1977 (a and b)	Teaching About Floating and Sinking : An Attempt to Link Cognitive Psychology with Classroom Practice.	Positive
41.	Smith, P.J. and VanZgeren, I.	1977	Piagetian Principles Used in a High School Chemistry Class.	Positive
42.	Wollman, W. and Lawson, A.E.	1977	Teaching the Procedure of Controlled Experimentation : A Piagetian Approach.	Positive
43.	Cantu, L.I. and Herron, J.D.	1978	Concrete and Formal Piagetian Stages and Science Concept Attainment.	Positive
44.	Linn, M.C. and Levine, D.I.	1978	Adolescent Reasoning:Influence of Question Formal and Type of Variables on Ability to Control Variables.	Positive
45.	Ross, G.C.	1978	A Study of the Influence of Formal High School Science and Maths Course Participation Sex and I.Q. on Level of Cognitive Development as Measured by Standard Piagetian and Alternate Tasks	Positive

Contd.....

1	2	3	4	5
46.	Warrent, T., Wollman, W. and Lawson, A.E.	1978	Reasoning in Seventh Graders	Positive
47.	Wright, E.L.	1978	The Effect of Film Mediated Intensive Instruction on Basic Problem Solving Skills of Ninth Graders.	Positive
48.	Edwards, Clifford H. and Surma, M.	1980	The Relationship Between Type of Teacher Reinforcement and Student Inquiry Behaviour in Science.	Positive
49.	Bawa, G.S.	1981	The Effect of Training and Intelligence on Formal Operational Thought (Stating and Testing Hypotheses).	Positive
50.	Riesz, E.D.	1981	The Effect of Training on Children's Classification Skills.	Positive
51.	Bevli, U.K.	1982	Concept Formation in Children, Eco-Cultural Context.	Positive

Contd......

1	2	3	4	5
52.	Sneider, C.I.	1982	Can Children Learn How to Control Variables ? A Neo-Piagetian Training Study in School and Non-School Settings.	Positive
53.	Campkell, L.H.	1983	The Effect of Cognitive Strategy Training on Reading Achievement and Piagetian Cognitive Level Among High Risk College Freshmen.	Positive

Table No. 3

TRAINING STUDIES

Sl. No.	Name of author(s)	Year	Title of the Studies	Type of Influence
1	2	3	4	5
1.	Rimoldi, H.J.A. and *et al.*	1962	Training in Problem Solving	Neutral
2.	Nasca, D.	1966	Effect of Varied Presentations of Laboratory Exercise Within of Programmed Materials on Specific Intellectual Factors of Science Problem Solving Behaviour,	Neutral

Contd...

1	2	3	4	5
3.	Dyrli, O.E.	1967	An Investigation Into the Development of Combinatorial Mechanisms Characteristics of Formal Reasoning, Through Experimental Problem Situations With Sixth Grade Students.	Neutral
4.	Davis, J.K.	1967	Concept Identification as a Function of Cognitive Style Procedures.	Neutral
5.	Ennis. Etal	1969	Conditional and Children	Neutral
6.	Buell, R.R. and Brainerd, C.J.	1972	Piagetian Studies in Science: Chemical Equilibrium Understanding From Study of Solubility.	Neutral
7.	Bradley, G.A.	1972	Reinforcement and Reversability in Quantity Conservation Acquisition.	Nautral
8.	Bredderman, T.A.	1973	The Effect of Training on the Development of the Ability to Control Variables.	Neutral

Contd...

1	2	3	4	5
9.	Brainerd, C.J.	1974	Training and Transfer of Transitivity Conservation and Class Inclusion Length.	Neutral
10.	Case, R.	1974	Structures and Strictures : Some Functional Limitations on the Course of Cognitive Growth.	Neutral
11.	Lawson, A.E., Blake, A.J.D. and Horland, F.H.	1975	Training Effects and Generalization of the Ability to Control Variables in High School Biology Students.	Neutral
12.	Linn, M.C. and Levine, D.I.	1976	Adolescent Reasoning : The Development of the Ability to Control Variables.	Neutral
13.	Wheeler, A.E. and Kass, H.	1977	Proportional Reasoning in Introductory High School Chemistry.	Neutral

Table No. 4

TRAINING STUDIES

Sl. No.	Name of author(s)	Year	Title of the Studies	Type of Influence
1.	Anfin, C.S.	1976	A Comparison of the Effectiveness of Direct Contact With Children in the Classroom Versus Indirect Contact via-Videotape in Piagetian Conservation Tasks in Preservice Teachers.	Negative
2.	Linn, M.C., Chen, B. and Thier, H.D.	1977	Teaching Children to Control Variables Investigation of a Free-Choice Environment.	Negative
3.	Stone, C.A. and Day, C.M.	1978	Levels of Availability of a Formal Operational Strategy.	Negative
4.	Wyatt, M.	1982	Formal Operational Thinking and the Role of Training.	Negative

Table No.5

TRAINING STUDIES

Sl. No.	Name of author(s)	Year	Title of the studies	Type of Influence
1.	Gunnels, F.G.	1967	A Study of the Development in Logical Judgements in Science of Successful and Unsuccessful Problems Solvers in Grades Four Through Nine.	Doubtful
2.	Raven, R.J.	1974	Programing Piaget's Logical Operations for Science Inquiry and Concept Attainment.	Doubtful
3.	Strauss, S. and Rimalt, I.	1974	Effect of Organizational Disequilibrium Training on Structural Elaboration.	Doubtful
4.	Silver, E.	1976	Relations Among Piagetian Grouping Structures : A Training Study.	Doubtful
5.	Boulanger, F.D.	1978	Interaction of Formal Operational Capability and Instructional Feedback Mode.	Doubtful
6.	Douglass, C.B. and Kahle, J.B.	1978	The Effects of Instructional Sequence and Cognitive Style on the Achievement of High School Biology Students.	Doubtful

MAIN FINDINGS EMERGING OUT OF THE RELATED LITERATURE :

After having gone through various researches related to the present study, four different views linked to the effect of training were observed. Some of the researchers conclude that training helps to accelerate learning. The second view is that training does not promote learning. The third view considers training to be neutral, i.e. training may be helpful in some cases but not in others. The fourth view reflects the doubtful effect of training, where the researchers are not in a position to coin the exact effect of training. Some of the main points that came into light are given below :

(1) If thinking is regarded as a mental skill based upon innate capacity, then training experience and practice influence thinking.

(2) Children not only develop scientific interests, confidence and responsibility by the practice of scientific method but are also capable of developing abilities in practicing the other elements of the scientific method.

(3) When scientific principles are approached through experiments, the non-verbal aspect of problem solving is influenced positively whereas no influence is noticed in the verbal aspect of problem solving.

(4) Pupils at the transitive stage between the concrete and formal stage of development show significant improvement as a result of training, otherwise there is no influence on the acceleration of skills.

(5) Training influences positively even when a new variant of the old problem is given.

(6) Training is positively helpful for the feedback groups.

(7) Use of thematic material improves performance.

(8) Training generates ideas and hypotheses.

(9) Pupils learning is facilitated through training and their knowledge is retained if they have some related prior concepts.

(10) A specific program of instruction facilitates the acquisition of the corresponding specific concepts under experimental conditions.

(11) Experimental group showed significant gains over the control group.

(12) Training is helpful in case of similar problem but not at all in the case of dissimilar problem.

(13) Training properly designed is helpful over a wide age range. However, younger pupils did need more of concrete instructions.

(14) Certain aspects of teaching - learning are helpful in the emergence of formal thought among those who are about in the last phase of concrete development.

(15) Specific training aids in the emergence of schemes of thought, e.g. exclusion of variables.

(16) The length of previous experience in science helped the male pupils more than the female pupils on Piagetian tasks.

(17) Inquiry behaviour can be significantly increased through reinforcement.

(18) Training on certain schemes of thought is more pronounced in higher grade.

(19) Use of formal reasoning in problem solving is dependent on age, mental age, and grade.

(20) Training procedures fail to influence performance differentially having even distinctly different cognitive styles.

(21) Three modes of instruction, namely, reinforcement, conflict, and repetition are little helpful in the development of ability to control variables.

(22) Training is more effective within and between concepts for subjects with structural mix than for those who have measured structural mix.

(23) The promotion of generalization to new problems at the end of training is limited.

(24) The trained concept is shown to be minimally general, but it is not shown to be durable accross time.

(25) Direct instruction, even properly planned is not helpful in enhancing a scheme of thought.

CONCLUDING STATEMENT :

The studies which have been reviewed do not yield a clear conclusion. The conflicting nature of the studies suggesting training may be effective, secondly, that training may be accomplished partially, thirdly, training is ineffective, fourthly, the effect of training is doubtful.

The studies on acceleration of thought in relation to educational practice have many drawbacks. These studies have great diversity of subjects, mode of instructions, method of

measuring learning and length of training and hence make it difficult to draw precise conclusions about the effect of the training.

Research in this area is just coming up. It is, therefore, not possible to answer the question whether the training techniques accelerated thinking or not. Over-generalization in this area may be quite dangerous. But it appears that accelerated thinking under certain conditions and within certain elastic limits is possible.

There is not a single problem in relation to outside variable that has been tackled at depth, though several others in varying contexts have been attacked. Taking an overall view, the problem is open for investigation, where no firm information is available, for this area is just being probed into.

CHAPTER - III

PLAN AND PROCEDURE

INTRODUCTION :

Once the process of thought is understood (Chapter I) it naturally raises a question whether this process of thought can be accelerated or not ? How can it be accelerated ? What are the hurdles in the way ? The evidences so far have left a field of uncertainty about these questions. No final statement can be made about the acceleration of thought. On the review of relevant literature and the psychological facts put forward by Jean Piaget in the field of education and intellectural development the major assumptions for the study were decided. On these assumptions were framed the objectives and hypotheses of the study. These research studies and the major assumptions were kept in view while framing the research design suitable for the systematic study of the hypotheses. This was followed by the selection of the sample, data gathering instruments, administration and scoring of the tests. Various statistical techniques were then used to analyse the data gathered with the help of these instruments. This chapter briefly describes these aspects of the study.

EXPERIMENTAL DESIGN :

The main emphasis of the study was to compare the effect of training on the experimental group, with the control group. For this matched groups were prepared. They were matched on intelligence,age, grade and socio-economic status with the help of various tools described later on in this chapter. Almost identical levels of intelligence, socio-economic status and age was mentioned grade wise and sex wise within the control and the experimental group.

The experiment was divided into three phases, viz., Pre-test, three-training sessions and Post-test. The entire sample thus matched was then split up into two major groups, the control group and the experimental group. This division of the sample was randomly done. Details of further division of the groups has been dealt with later on in this chapter. Here, the important thing to know is the treatment given to the control and the experimental group.

Procedure for stimulating problems :

This comprised the first procedure of the study. Every student of both the control and the experimental group were asked to solve four problems in the question formate given to them. These problems were the Digital Problem, the Beaker Problem, the Seed Problem and the Worm Problem. The first three problems were based on combinational scheme of thought and the last was based on exclusion of variable scheme of

thought. The purpose of these stimulating problems were to motivate the students to think, be able to exhaust majority of the various phenomena (combinations) and to pick the relevant variable by excluding the irrelevant variable. They also become familiar with how to deal with the problems of the pre-test. The students were asked to record their answers in the space provided under each question. It was also ensured that the sequence in answering the question was maintained.

Procedure for Pre-test :

Immediately after the stimulating problems the student were asked to solve the problems of the pre-test. The pre-test problems were printed in a separate booklet. The test was administered simultaneously to the control and experimental group. Pre-test consisted of five Piagetian Problems viz., the Wax Problem, the Bending of Rod Problem, the Ramp Problem, the Flow of Liquid Through a Tube Problem and the Simple Pendulum Problem, based on two scheme of thought, viz., the separation and controlling of variables and exclusion of variable. The former dealt with finding out the effect of the variations of one variable when the other causative variables are held constant. The latter follows an isolating strategy. That is the non-causative or irrelevant variables of a certain phenomenon, are excluded. Students recorded their answers in the space provided below each question. Blank

paper was also supplied to those students who required extra space to complete their answers. The sequence of the questions was maintained.

Training sessions :

This part of the procedure consisted of three training sessions. Each training session was conducted at an interval of approximately two weeks. It was planned to have more training sessions if necessary i.e., if the results were unsatisfactory. Due to the constraints of the school conditions this, however, could not be carried out. Training was imparted only to the experimental group.

First Training Session :

Students were first supplied with the question booklet. The problems were the same as that of the Pre-test. Each problem, however, had various sub-processes in accordance with the variables. This was done so that the students could solve the problem step by step and verify their conclusions. The mode of presentation was different for the problems. The Wax Problem was executed orally, that is, the main equipment was adjusted in the presence of the students. Each sub-process was orally put forward, without actually performing the experiment. For the next two problems, that is, the Bending of Rod and the Ramp Problem, demonstration method was employed. That is the investigation with the help of a couple

of students performed each step or sub-process according to the variations of the variables keeping all but one constant. The fourth problem, that is, the flow of liquid through a tube was presented pictorially. That is each sub-process was shown with the help of a diagram. For the fifth problem, ie the Simple Pendulum Problem experimental method was adopted. The students seemed very curious to handle the apparatus themselves. To bring about variety in solving the problems and not wishing tc suppress their urge, they were allowed to perform the experiment according to the variation they desired and draw conclusions. These sub-processes were performed in small groups. They were, however, asked to record their observations.

Before the actual training process could commence the investigator gave the students an example of drying up of an handkerchief to solve verbally. After posing the example the investigator asked the students to give the name of the variables. The variables they gave were size, material of the handkerchieves, atmospheric conditions, design and colour of the handkerchieves, dampness of the cloth,etc. Then each variable was separately dealt with in the same manner as was in the training session formate for other problems. Then the training session began. Each step for each problem is discussed ahead in this chapter. After a gap of approximately two weeks second training session began.

Second training session :

Once again hint was given to a few lower graders only, with the handkerchief problem. Experiments were conducted in the same way as in the first training session. The time taken by the students to solve the five Piagetian task was much less than the first training session.

Third training Session :

After a gap of approximately two weeks from the second training session the third training session was given. The investigator did not give any hints. The students completed their problems faster than they did so in the second training session. The procedure was the same as in the previous sessions.

There was no fourth training session due to the constraints of the school conditions yet it was seen that the performance of the students was almost what was expected of them.

Post-test :

Immediately after the third session, post-test was conducted on both controlled and experimental groups simultaneously. Post-test was identical to the Pre-test.

DESCRIPTION, ADMINISTRATION AND SCORING PROCEDURE OF THE TOOLS :

Raven's Progressive Matrix :

In order to form the experimental and control groups the students in the two groups had to be matched on intelligence. For this purpose, the investigator had to measure intelligence of a large number of students within a short period of time so it was decided to use group test of intelligence. Further, to avoid the problem of language comprehension, a group non-verbal test was used for the study. Thus the test selected for this purpose was Raven's Progressive Matrix test.

Raven's standard progressive matrices test (RPM) has A, B, C, D and E parts. In all it comprises of sixty items - twelve in each part. Each item consists of a design or matrix. This test was conducted on the students of classes VII, VIII, IX and X.

The testee examines the matrix. A small portion in the matrix is missing. Below the matrix six possible answers are given in the form of same designs. The testee chooses the correct answer in order to complete the matrix, i.e., make the design a whole. The easier problem draw principally on discrimination, the more difficult ones on reasoning by analogy. The problems are divided into series - five in

case of standard matrices each with twelve problems arranged in order of easy to difficult. The answers have to be given in a separate answer sheet so that the test booklets can be used over and over again. To ensure sustained interest and avoid fatique, the designs of each problem are boldly presented and accurately drawn.

Retest reliability of the test as worked out by Raven (1960), varies from person to person in different age range, but never goes below 0.83. Raven also provides satisfactory relationship of this test with Mill Hill vocabulary scales and Terman Merill Intellegence Quotent.

Masih (1973) worked out the split half reliability of this test on biology students of Higher Secondary Schools of Rajasthan. The value of 'r' has been calculated by Pearson's Product Moment method. This value has been corrected by Spearman Brown Prophecy formula to provide an estimate of the internal consistency of test scores earned by representative groups of biology students. Reliability was worked out to be 0.90.

Administration : In order to prepare the matched groups, the RPM test was conducted on a much larger population from each grade than was actually required for the study. This was done in order to leave a sufficient residue in the groups after eliminating the population not falling

under the criteria of the matched group formation. The test was administered in a classroom situation. Each student was provided with a question booklet and a separate answer sheet. The students were not time bond. The first item of the first part was solved aloud in the class so that every student knew what and how he was expected to do. Generally the sequence of answering the parts was maintained. The number below the right answer is jotted down in the answer sheet.

Scoring procedure : There were five parts with twelve items each. That means there were sixty items. The scoring was done according to the manual. Each right answer carried one mark each. Thus the maximum marks were sixty. To facilitate the work, a scoring key was constructed by the investigator. The marks awarded to each student was according to the number of right answers he gave. On the basis of this scoring, a person is said to be intelligent if he has secured more marks i.e., from 45 to 60. If a person has secured less than 15 he is said to be possessing low intelligence. These raw scores obtained were used to obtain the various objectives of the study.

Socio-Economic Status Questionnaire :

To enable the investigator to prepare the control and experimental groups, the sample were matched against socio-economic status.

The socio-economic status questionnaire was constructed on the basis of Socio-economic status scale questionnaire (SESSQ) constructed by S. Jalota; R.N. Pandey; S.D. Kapoor and R.N. Singh. One type questionnaire was opted for so that the student had a greater freedom for answering.

The questions were basically divided into three broad categories - Education, Occupation and Income of the parents. These were again sub-categorised as follows :

Education :
(a) Illiterate
(b) Primary
(c) Higher Secondary
(d) Graduate
(e) Post-graduate
(f) Degree in professional education

Occupation :
(a) Unskilled - labour, etc.
(b) Partially skilled workers - farmers, peon, fourth class servants.
(c) Clerical jobs - clerk, salesman, technician, small businessman, primary or middle school teacher
(d) Junior officers - lawyer, doctor, shopkeeper, Higher secondary teacher, lecturer
(e) High class officers - Professors, administrators, big lawyers, doctors (M.D. & M.S.)

Income :	(a)	Re 1	-	Rs. 100
	(b)	Rs. 101	-	Rs. 200
	(c)	Rs. 201	-	Rs. 400
	(d)	Rs. 401	-	Rs. 1000
	(e)	Rs. 1001	-	Rs. 1500
	(f)	Rs. 1501	and above	

Administration : The subjects were provided with the formate designed by the investigator. They were asked to read the instructions carefully and only then to answer. Before answering the questions on the formate they were asked to fill up the entries preceding the questions. These were the name, age, grade, section, sex, name of the school, date, etc. The main purpose behind these entries was not only to prepare the control and experimental group but match them against age and grade as well. These entries were checked later on with the school record. They were given freedom to answer in accordance with their social-economic status conditions. Each category had to be mentioned differently for both the mother and the father. Special mention was also made for the type of family and earning members. This formate too was free of any time limit. The test was administered to a big population gradewise so that matched group number could be satisfactorily selected.

Scoring Procedure for Socio-Economic Status Questionnaire:

As stated earlier, the questionnaire was constructed on the basis of Socio-Economic Status Scale. Questionnaire

constructed by S. Jalota, R.N. Pandey, S.D. Kapoor and R.N. Singh. The scoring procedure was also similar. Points awarded for each category is given below. The maximum points for each category was six.

Education :

(a)	Illiterate	..	1 Point
(b)	Primary education	..	2 Point
(c)	High Secondary	..	3 Point
(d)	Graduate	..	4 Point
(e)	Post-graduate	..	5 Point
(f)	Degree in professional education	..	6 Point

Occupation :

(a)	Unskilled (labour, etc.)		1 Point
(b)	Partially skilled (Farmer, peon, fourth class servants)	..	2 Point
(c)	Clerical job (clerk, salesman, technicians, small businessman, primary or middle school teachers)		3 Point
(d)	Non-Gazetted Officers (lawyer, doctor, shopkeeper, Higher secondary teachers, lecturers)		4 Point
(e)	Gazetted Officers (Professors, administrators, judges, doctors (M.D. & M.S.)	..	5 Point

Income :

(a)	Re 1 to Rs. 100	..	1 Point
(b)	Rs. 101 to Rs. 200	..	2 Point
(c)	Rs. 201 to Rs. 400	..	3 Point
(d)	Rs. 401 to Rs.1000	..	4 Point
(e)	Rs.1001 to Rs.1500	..	5 Point
(f)	Rs.1501 and above	..	6 Point

Cattell's H.S.P.Q. :

One of the aims of the study was to determine the relationship between the various personality traits and the three levels of intellectual development. Another aim was to determine the personality traits of those students who were favourably influenced by the training. Personality factors were also considered for factor analysis. For this a standarized test of personality "The Jr. Sr. High School Personality Questionnaire (Hindi version) was given to each student of each grade in a classroom situation. Form A was used. The H.S.P.Q. measures fourteen distinct dimensions of personality of persons between age 12 to 18.

The Hindi version prepared by Kapoor and Mehrotra consisted of hundred and fourteen questions. Each question was constructed in one line. Each question had three possible answers. This test includes all of the more adequately research-demonstrated dimensions of personality from the

general personality sphere. Answer sheets are separate so that the test booklets can be used again. This test was administered in groups.

A brief description of the fourteen personality traits has been given below in a tabular form.

Table No.6

Characteristic expressions of the traits

S. No.	Low Score	Versus	High Score
1	2	3	4
1.	**FACTOR A (-)**		**FACTOR A (+)**
	SIZOTHYMIA	Vs	AFFECTOTHYMIA
	(Reserved, detached, critical, aloof, stiff)		(Good natured, easygoing, outgoing and participating)
	(a) Critical	Vs	Good natured, easygoing
	(b) Stands by his own ideas	Vs	Ready to cooperate, likes to participate
	(c) Cool, aloof	Vs	Attentive to people
	(d) Precise, objective	Vs	Softhearted, casual
	(e) Distrustful, skeptical	Vs	Trustful
	(f) Rigid	Vs	Adaptable, careless, Goes alone.
	(g) Cold	Vs	Warmhearted
	(h) Prone to Sulk	Vs	Laughs readily.

1	2	3	4
2.	FACTOR B (-)		FACTOR B (+)
	LOW INTELLIGENCE	Vs	HIGH INTELLIGENCE
	(Crystallized Power Measure, Dull)		(Crystallized, Power Measure, Bright)
	(a) Low mental capacity	Vs	High mental capacity
	(b) Unable to handle abstract problems	Vs	Insightful, fast-learning, Intellectually adaptable
3.	FACTOR C (-)		FACTOR C (+)
	EMOTIONAL INSTABILITY	Vs	HIGHER EGO STRENGTH
	(Affected by feelings, emotionally less stable, easily upset, changeable)		(Emotionally stable, mature, faces reality, calm)
	(a) Gets emotional when frustrated	Vs	Emotionally mature
	(b) Changeable in attitudes and interests	Vs	Stable, constant in interests
	(c) Easily perturbed	Vs	Calm
	(d) Evasive of responsibilities, tending to give up.	Vs	Does not let emotional needs obscure realities of a situation, adjusts to facts.
	(e) Worrying	Vs	Unruffled
	(f) Gets into fights and problem situation	Vs	Shows restraint in avoiding difficulties

1	2	3	4
4.	FACTOR D (-)		FACTOR D (+)
	PHLEGMATIC TEMPERAMENT	Vs	EXCITABILITY
	(Undemonstrative, deliberate, inactive, stodgy)		(Excitable, impatient, demanding, overactive chrestrained)
	(a) Stoical	Vs	Demanding, impatient
	(b) Complacent	Vs	Attention-getting, showing off.
	(c) Delibrate	Vs	Excitable, overactive
	(d) Not easily jealous	Vs	Prone to jealousy
	(e) Self-effacing	Vs	Self-assertive, egotistical.
	(f) Constant	Vs	Distractible
	(g) Not restless	Vs	Shows many nervous symptoms
5.	FACTOR E (-)		FACTOR E (+)
	SUBMISSIVENESS	Vs	DOMINANCE OR ASCENDANCE
	(Obedient, mild, easily led, docile, accomodating)		(Assertive, aggressive, competitive, stubborn)
	(a) Submissive	Vs	Assertive, self-assured
	(b) Dependent	Vs	Independent-minded
	(c) Considerate, diplomatic	Vs	Stern, hostile
	(d) Expressive	Vs	Solemn

1	2	3	4
	(e) Conventional, conforming	Vs	Unconventional
	(f) Easily upset by authority	Vs	Headstrong
	(g) Humble	Vs	Admiration demanding
6.	FACTOR F (-)		FACTOR F (+)
	DESURGENCY	Vs	SURGENCY
	(Sober, taciturn, serious)		(Enthusiastic, headless, happy-go-lucky)
	(a) Silent, introspective	Vs	Talkative
	(b) Full of cares	Vs	Cheerful
	(c) Concerned, Reflective	Vs	Happy-go-lucky
	(d) Incommunicative, sticks to inner values	Vs	Frank, expressive, reflects to group.
	(e) Slow, cautious	Vs	Quick and alert
7.	FACTOR G (-)		FACTOR G (+)
	LOW SUPEREGO STRENGTH or LACK OF ACCEPTANCE OF GROUP MORAL STANDARDS	Vs	SUPEREGO STRENGTH or CHARACTER
	(Disregards rules, expedient)		(Conscientious, persistent moralistic, staid)

1	2	3	4
	(a) Quitting, fickle	Vs	Persevering, determined
	(d) Frivolous	Vs	Responsible
	(c) Self-indulgent	Vs	Emotionally disciplined
	(d) Slack, indolent	Vs	Consistently ordered
	(e) Undependable	Vs	Conscientious, dominated by sence of duty
	(f) Disregards, Obligations to people	Vs	Concerned about moral standards and rules
8.	FACTOR H (-)		FACTOR H (+)
	THRECTIA	Vs	PARMIA
	(Shy, timid, restrained, threat-sensitive)		(Adventurous, thick-skinned, socially bold)
	(a) Shy, withdrawn	Vs	Adventurous, likes meeting people
	(b) Retiring in face of opposite sex	Vs	Active, overt, interest in opposite sex
	(c) Emotionally cautious	Vs	Responsive, genial
	(d) Apt to be embittered	Vs	Friendly
	(e) Restrained, rule-bound	Vs	Impulsive
	(f) Restricted interests	Vs	Emotional and artistic interests
	(g) Careful, considerate quick to see dangers	Vs	Carefree, does not see danger signals

1	2	3	4
9.	FACTOR I (-)		FACTOR I (+)
	HARRIA	Vs	PREMSIA
	(Tough-minded, rejects illusions)		(Tender-minded, sensitive, dependent, overprotected)
	(a) Unsentimental, expects	Vs	Fidgety, expecting affection and attention
	(b) Self-reliant, taking responsibility	Vs	Clinging, insecure, seeking help and sympathy
	(c) Hard (to point of cynicism)	Vs	Kindly, gentle, indulgent to self and others.
	(d) Few artistic responses	Vs	Artistically, fastidious, affected, theatrical
	(e) Unaffected by "Fancies"	Vs	Imaginative in inner life and in conversation
	(f) Acts on practical, logic evidence	Vs	Acts on sensitive intuition
	(g) Keeps to the point	Vs	Attention-seeking, flighty
	(h) Does not dwell on physical disabilities	Vs	Hypochondrical, anxious about self.
10.	FACTOR J (-)		FACTOR J (+)
	ZEPPIA	Vs	COASTHENIA
	(Zestful, liking group action)		(Circumspect individualism, reflective, internally restrained)
	(a) Likes to go with the group	Vs	Acts individualistically

1	2	3	4
	(b) Likes attention	Vs	Guarded, wrapped up in self
	(c) Sinks personality into group enterprise	Vs	Fastidiously obstructive
	(d) Vigorous	Vs	Neurasthenically fatigued
	(e) Accepts common standards	Vs	Evaluates coldly
11.	FACTOR O (-)		FACTOR O (+)
	UNTROUBLED ADEQUACY	Vs	GUILT PRONENESS
	(Self-assured, placid, secure, complacent, sevene)		(Apprehensive, self-reproaching, insecure, worrying, troubled)
	(a) Self-confident	Vs	Worrying, anxious
	(b) Cheerful, resilent	Vs	Depressed, cries easily
	(c) Impatient, placid	Vs	Easily touched, overcome-by moods.
	(d) Expedient, insensitive to people's approval or disapproval	Vs	Strong sense of obligation, sensitive to people's approval and disapproval
	(e) Does not care	Vs	Scrupulous, fussy
	(f) Rudely vigarous	Vs	Hypochondrical and inadequate
	(g) No fears	Vs	Phobic symptoms
	(h) Given to simple action	Vs	Lonely, brooding

1	2	3	4
12.	FACTOR Q_2 (-) GROUP DEPENDENCY (Sociably, group dependent, A 'joiner' and sound follower	Vs	FACTOR Q_2 (+) SELF-SUFFICIENCY (Self-sufficient, resourceful, prefers own decisions)
12.	FACTOR Q_3 (-) LOW SELF-SENTIMENT INTEGRATION (Uncontrolled, lax, follows own urges, careless of social rules)	Vs	FACTOR Q_3 (+) HIGH STRENGTH OF SELF SENTIMENT (controlled, exacting will power, socially precise, compulsive, following self-image)
13.	FACTOR Q_4 (-) LOW ERGIC TENSION (Relaxed, tranquil, torpid, unfrustrated, composed)	Vs	FACTOR Q_4 (+) HIGH ERGIC TENSION (Tense, frustrated, driven, overwrought, fretful)

Retest reliability of the test was worked out for each factor :

FACTORS	A	B	C	D	E	F	G
FORM A	.68	.61	.67	.59	.77	.67	.65

FACTORS	H	I	J	Q	Q_2	Q_3	Q_4
FORM A	.65	.75	.51	.70	.72	.61	.77

The concept validity coefficients derived as the square root of equivalence :

FACTORS	A	B	C	D	E	F	G
Coeffs.	.70	.63	.72	.72	.56	.65	.71

FACTORS	H	I	J	Q	Q_2	Q_3	Q_4
Coeffs.	.71	.68	.84	.87	.87	.86	.86

Administration : The test was administered in a class room situation. The time required for administration was about forty to fifty minutes. Each student of the control and the experimental group was provided with a question booklet and separate answer sheet. The procedure of the test was explained verbally so that everyone was able to understand clearly how responses are to be made. During the test, meaning of words were explained to an examinee, upon request. The investigator took constant rounds in the class to see that the instructions have been understood. Each page of the test booklet corresponded to a column on the answer sheet.

Scoring Procedure for H.S.P.Q. :

Separate answer sheet was provided to each student. The completed answer sheet is the primary record from which the scores can be obtained.

Each answer sheet was scored by hand stencil key, which consisted of two parts. This key was adjusted by check holes to the answer sheet. Above each hole 1 or 2 numbers are already written. The number of those holes which tallied with the ✓ mark of the answer sheet were added for any one factor at a time - from left to right. The total was entered in the space at the right hand for that factor in the "Raw Score" column, of the answer sheet. This was repeated for each factor, 7 factor in each key.

These raw scores for each factor were converted into sten scores from supplements of norms given in the manual. The raw scores mean of the population is taken by the conventional sten table as the central point of the ten-point (sten) scale. Thus, what are usually called "average" or "normal" scores of a trait are represented by sten score 5 and 6. If the sten scores are 1, 2, 3 and 8, 9, 10, then the person is said to be definitely departing from the average. These sten scores have been used to find out the various relationship of personality traits with other variables of the study.

Piagetian tasks :

Perhaps the most important single proposition that the education can derive from Piaget's work, and thus use in the classroom is that children learn best from concrete activities. Piaget places major emphasis on the role of

activity in intellectual development. One of the major sources of learning, if not the most essential one, is the intrinsic activity of the child. A child must act on things to understand them. A child manipulates the things he handles. It is through manipulation that he develops schemes relating to objects.

The present study's main objective, i.e. the effect of training on intellectual development is motivated by the above theme. Piaget has given no comment on training, yet in the present study various Piagetian tasks related to three scheme of thoughts have been chosen. These have been described below :

Table No.7

Piagetian Tasks Used in the Study

S.No.	Name of task	Scheme of thought
1	2	3
(Stimulating Problems)		
1.	Digital problem	Combinatorial
2.	Beaker problem	Combinatorial
3.	Magic seed problem	Combinatorial
4.	Worm problem	Exclusion of irrelevant variables

Contd...

1	2	3
(Pre-test and Post-test Problems)		
5.	Wax problem	Separation and control of variable
6.	Bending of Rod problem	Separation and control of variable
7.	Ramp problem	Separation and control of variable
8.	Flow of liquid through a tube	Exclusion of irrelevant variables
9.	Pendulum problem	Exclusion of irrelevant variables

Table No.8

Selection of the Problem

S. No.	Scheme of thought	Objectives	Task
1	2	3	4
1.	Combinatorial problem	Each pupil should be able to exhaust at least 80% of the possibilities of the various combinations.	(a) Digital problem (b) Beaker problem (c) Seed problem

Contd....

1	2	3	4
2.	Separation of variables	The student must be able to indicate the important effecting factors "other things being equal".	(a) Wax problem (b) Bending of the rod problem (c) Ramp problem
3.	Exclusion of variable	The students picks up the irrelevant variables.	(a) Worm problem (b) Flow of liquid through a tube problem (c) Simple pendulum problem

Reliability of the Problems :

After the selection of the problems were finalized they were put into a written form. The test was conducted on sixty students, twenty each from grade seven to nine. These students were randomly selected. Same test was then repeated on the same students after a gap of two months. reliability of test was calculated which is being given in Table No.9.

Table No. 9

S.No.	Problem	Reliability coefficient
1.	Digital problem	0.863
2.	Beaker problem	0.872
3.	Magic seed problem	0.779
4.	Worm problem	0.762
5.	Wax problem	0.654
6.	Bending of rod problem	0.812
7.	Ramp problem	0.753
8.	Flowing of liquid through a tube problem	0.826
9.	Pendulum problem	0.683

The tasks were selected after having gone through various concerned references. These were then discussed individually with experts. The questions were framed for each problem. In all sixteen problems were chosen out of which nine were retained.

A test was constructed and conducted on twenty students randomly selected from grade VII to IX of Regional College, Ajmer. On the basis of their responses, a final format was prepared. The language of each problem was thus framed.

After preparing the final format the Questionnaire was again discussed with the experts. This was then re-written in Hindi with the help of Hindi teachers of Vidya Bhawan Teachers' College and Vidya Bhawan Higher Secondary School. Help was also taken from some science teachers. The problems were judged with respect to language comprehension and the presentation of figures, apparatus or process involved in each step of the problem.

The Questionnaire was then conducted on students of various grades of Jyoti Bal Vidyalaya, Udaipur. The problem were understood correctly by 75% of the students. This was found so after analysing the responses of the students.

After making necessary changes, the final set of 5 problems for pre-test and 4 problems for stimulating were printed.

1. DIGITAL PROBLEM :

There are four digits - 6, 7, 8, 9. By combining two, three or four digits, make as many numbers as possible. (The students are to use a digit only once in one combination.)

This problem is based on the combinatorial scheme of thought as propounded by Jean Piaget. The pupil can make twelve combinations by using two digits, twenty four combinations by using four digits. Hence in all they can make sixty such combinations.

2. BEAKER PROBLEM :

There are four beakers A, B, C, D filled with different colour liquid in each. There is another beaker E filled with a colourless liquid. When some drops of the liquid from beaker A, B, C, D are added haphazardly to the liquid of E beaker the solution of beaker E turns yellow. What are the possible combinations which can lead to the yellow colour of the liquid in beaker E. The students can use one, two, three or all the four beakers A, B, C, D).

This problem is based on the combinational scheme of thought. This problem has fifteen sub-process. Four sub-process using one beaker, six sub-process of using two beakers, four sub-process using three beakers and one sub-process using all the four beakers.

3. MAGIC SEED PROBLEM :

A farmer has a bag of seeds with him. He wants to grow them into healthy seedlings which he does not know how. The only thing he knows is that their growth depends upon three factors - water, fertilizer and sunlight. His problem is to find out the right quantity of these factors. He divided each factor into three quantities high, low, medium. He brings as many earthen pots as there were combinations. How many pots did he buy ?

This problem is based on the combinational scheme of thought. It has twenty seven possible combinations, nine for each factor; using three different quantities in each combination.

4. WORM PROBLEM :

A student while taking a stroll in the garden came across some attractive worms. He wants to raise them as pet, but he does not know the condition for their survival. He puts the worms in four glass boxes each with different conditions. These conditions were as follows :

Light, dry - wet.
Light, dry - dry.
Dry - wet, light.
Wet - wet, light.

The movement of the worms can be concluded by seeing the number of worms at each end of the tube. This movement is in accordance with the favourable conditions for the survival of the worms. Which is/are the conditions ?

This problem is based on the exclusion of irrelevant variable scheme of thought. The problem comprised of three parts. The first part showed two boxes with different conditions. One end of each box was dry and the other end of one box was wet and the other end of the other box was dry. Light was provided towards the dry side of the box. A larger number of worms clustered round the dry and light side of the

tube. In the next part again there are two boxes each with different conditions. Both the boxes had wet conditions on one side. But one end of the one box is dry and the other end of the other box is wet. Light is provided towards the wet side of the box. More worms are seen clustering round the wet side towards the light.

The last part of the problem was to enable the student to find out which was the important factor, necessary for the movement of the worms, on the basis of the answers given to the previous two sub-parts. Hence only one factor was vital and the rest not having any effect.

This problem is based on exclusion of irrelevant variable scheme of thought, where a testee excludes the irrelevant variable and makes a mention only of the causative variable.

5. THE WAX PROBLEM :

This problem was based on the separation and controlling of variables.

The experiment consisted of the following apparatus. A stand on which a rod could be fixed with the help of a clamp. Two rods of same length , same diameter but different material, two rods of same length, same material but different diameter, two rods of same material, same diameter but different length.

In the pre-test, diagram of the above experiment was shown. The students were asked to find out on which variables did the falling of wax balls depend.

In the training session experiments performed were varied according to the variables. All the exercises were put forward verbally. No demonstration or experimentation was adopted. Using two rods of different material but same diameter, same length. The pupils were asked to observe the time taken for the wax balls to fall in each case. Then in the next part of the same experiment two rods of different diameter but same material, same length were taken. Time taken for the wax ball to fall were noted. The third part was with two rods of different length but same material and diameter. The students were asked to draw their conclusions in a format given by the investigator. Both the variables when tackled independently do affect the melting of wax. For independent affect variation the all but the varying variable were constant.

The post-test was similar to the pre-test.

6. BENDING OF RODS :

This piagetian task was based on the separation and control of variables, i.e. for a complete solution to be attained each factor must be varied independently and others held constant.

The experiment consisted of six rods; two made of iron, but both of different diameter; two made of copper but both of different diameter; two of brass but both of different diameter. These rods were made in such a way that three rods of each material were same in diameter - say thickness. The other three rods each of different material were similar in diameter were thinnerthan the above mentioned three rods. These six rods could be fixed in the wooden plank which had holes right through them. By either pulling back or pushing out the rods through the holes in the wooden plank, their length could be adjusted i.e., length can be increased or decreased. Some weights could be hung at one end of the rods; the other end of the rods being fixed in the wooden plank. These weights were kept constant throught the exercises. The students are asked to find the variables which affect the bending of rods.

In the Pre-test no demonstration was given. However, the students were asked to find out those variables which were responsible for the bending of the rods. Answers were recorded on the question format provided to each student.

In the training session exercises the first part consisted of rods of different length, but similar in material and thickness. Weights (kept same for all the processes) were hung at the tip of each rod. The difference in the bending of the rods were observed and the students were asked to record their conclusion.

In the next exercise the rods were of different material but same in length and thickness. After hanging weights of same quantity at the end of each rod the effect was observed and conclusions were drawn.

The last exercise consisted of rods having same length, and material but different diameter. The effect of weight was observed for each rod and the conclusion were drawn.

The Post-test was identical to the pre-test.

7. THE RAMP PROBLEM :

This Piagetian task was based on the separation and control of variables put forward by Piaget as all but one equal.

The experiment consisted of three ramps of different material, same angle, same material, different angles, two balls of same size but different weight and material, same weight but different size and material, same material but different in weight and size. The Pre-test was similar to the bending of rods and wax problem. The problem was explained to the students. They were asked to describe the variables responsible for the movement of the target ball.

In the training sessions the experiment was demonstrated in four short exercises. In the first exercise the weights of the target balls and hitting ball is different.

The angle of the ramp, the size of the balls, the surface of the ramp are the same. First a lighter ball is hit by a heavier ball. Then the heavier ball is hit by the lighter ball. The difference in the movement of the target ball placed at the centre of the ramp is noted in both the cases. The students were asked to draw their conclusion.

In the second exercise the size of the hitting ball and the target ball is different. They are however, same in weight. The angle and surface of the ramps are the same. First bigger ball is hit by the smaller ball. Then the smaller ball is hit by the bigger ball. The students were asked to conclude their observations.

In the third part of the problem the angle of the ramps were different. The size and weight of the hitting and the target ball was the same. The surface of the ramps were the same. Students draw conclusions by observing the difference in both the cases.

In the last part of the problem the surface of the ramps were different. The angle of the ramps were, however, same. The size and weight of the hitting ball and the target ball was the same. The students on seeing the movement of the target ball in both the cases drew their own conclusions.

The post-test was similar to the pre-test.

8. FLOW OF LIQUID THROUGH A TUBE :

This task was based on exclusion of irrelevant variable scheme of thought i.e, picking up relevant variables and excluding irrelevant variables.

The experiment consisted of beakers of same size. To each beaker was connected glass tubes with a lot of variations. These tubes had a hole so that liquid from the beaker could flow through them. The length of the tubes, the size of holes of the tubes were different. Each factor was varied independently keeping other factors constant.

The pre-test consisted of the problem in the form of a diagram followed by the question, asking the pupils to name the dependent factors on which the flow of liquid through a tube depends.

In the training sessions this problem was dealt through picture presentation. Each variable was proved independently through four exercises.

In the first exercise there were three beakers of the same size. These beakers were labelled as A_1, A_2, A_3. Each beaker had a glass tube attached to it. The length of the glass tube was different in each beaker. The size of the hole in each case was the same. There were three beakers kept below the tube so that the amount of liquid flowing

through the tubes of beakers A_1, A_2 and A_3 could be collected. These were the collecting beakers B_1, B_2, B_3. The beakers A_1, A_2 and A_3 were kept at a higher level than B_1, B_2, B_3. The distance between $A_1$and B_1, A_2 and B_2 and A_3 and B_3 were the same. Same amount of liquid was filled in bearkers A_1, A_2 and A_3. The amount of liquid flowing through the tube into the collecting beakers, for a definite time period was observed . The time period was kept constant for all the exercises.

In the next exercise, bearker A_1, A_2 and A_3 were exactly alike. The length and diameter in all the beakers were the same. The distance between A_1 : B_1, A_2 :B_2 and A_3 : B_3 was different. Same amount of the liquid was filled in A_1, A_2 and A_3. Amount of the liquid collected in B_1, B_2 and B_3 in a definte time period was noted and conclusions drawn.

In the third exercise beaker A_1, A_2 and A_3 were exactly alike. The size of the hole (diameter) of the tube and the length of the tube was the same. The distance between A_1 : B_1, A_2 : B_2 and A_3 : B_3 was the same. But the amount of the liquid in A_1, A_2 and A_3 was different. The amount of liquid collected in B_1, B_2 and B_3 in a definite time period was observed and conclusions drawn.

In the last exercise beakers A_1, A_2 and A_3 were exactly alike. The length of the glass tubes in each beaker was

the same. But the diameter of the hole of the tube in each case was different. The distance between A_1 : B_1, A_2 : B_2 and A_3 : B_3 was the same. The amount of liquid in A_1, A_2 and A_3 was the same. The amount of liquid collected during a specific time period was noted and conclusions drawn.

The post-test was extactly alike the pre-test.

9. PENDULUM PROBLEM :

This Piagetian task was based on the exclusion of irrelevant variable scheme of thought. In this scheme the student exclude the irrelevant factors and only the affecting factor is pointed out.

The pre-test consisted of a simple pendulum problem in a question form. The variables responsible for the occilation of the bob was asked to be reported.

The training sessions consisted of three short exercises. The students were free to perform the experiments. In the first exercise three bobs were suspended from a single rod which was fixed on a stand. The length of the string of each bob was the same. The size of the bobs was the same. The weights of the bobs was different. All the three bobs were given on equal push with the help of a ruler. The oscillation of each bob was observed and conclusions were drawn.

In the next exercise again three bobs were suspended from a single rod. The length of the strings of each pendulum was the same. The weights of the each bobs was the same. But the size of each bob was different. All the three pendulums were given an equal push with the help of a ruler. The oscillation of each bob was observed and conclusions were drawn.

In the third exercise there were three pendulum. The size of each bob and the weight of the bobs were the same, but the length of the string was different, equal amoung of push was given to the pendulums. Oscillation of each pendulum was noted and conclusions drawn.

In the experiment only one of the possible factor actually plays a vital or causal role. Since the others have no effect they must be excluded after they have been isolated. The variable on seeing the apparatus, one might think to be relevant are, the length of the string, the height of the dropping point (amplitude of the oscillation) and the force of the push given by the subject, the weight and the size of the object fastened to the string. Since only the length of the string is actually the relevant factor with the help of the above exercise it was isolated from the others and were hence excluded. In this way the subject explained and varied the frequency of oscillation and solved the problem.

The post-test was identical to the pre-test.

Administration : The nine Piagetian type tasks finally chosen were then split up into two part.- the stimulating problems and the pre-test. The stimulating problems comprised of four tasks, viz., the Digital problem, the Beaker problem, the Seed problem and the Worm problem. These were printed on a separate booklet. The five tasks for the pre-test were the Wax problem, the Bending of Rod problem, the Ramp problem, the Flow of Liquid through a Tube problem and the Simple Pendulum problem. These five problems were printed in another booklet. Thus there were two booklets. Each student of the class was first supplied with the Questionnaire booklet containing the stimulating problems. After filling the preliminary inquires of the first page, they were given instruction on how they had to deal with the problems. They were asked to record their answer in the booklet itself.Blank space for this purpose was provided below each question. The sequence followed in the question was mentioned. After every student had finished their problems, they were asked to keep the booklet face down on the top corner of the dest. Meanwhile, Pre-test booklets, with the help of the students were distributed. They were asked to read the instructions carefully and then answer the questions in the booklet itself. The administrating procedure for Post-test was the same. For

the three training sessions each student was supplied with a separate booklet for each training session. The formate has been described earlier.

SCORING PROCEDURE FOR PIAGETIAN TYPE TEST :

Table No. 10

Showing the Steps for the Solution, Marks for each step and the total weightage for the problem

Sl. No.	Name of the problem	Steps for the solution of the problem	Mark for each step	Total weightage for each problem
1	2	3	4	5
1.	**DIGITAL PROBLEM**	1-4 combination	1 Mark	15 Marks
	Two digit-12 combinations, three digits-24 combinations, four digits 24 combinations (60 combinations)	5-8 ,,	2 ,,	
		9-12 ,,	3 ,,	
		13-16 ,,	4 ,,	
		17-20 ,,	5 ,,	
		21-24 ,,	6 ,,	
		25-28 ,,	7 ,,	
		29-32 ,,	8 ,,	
		33-36 ,,	9 ,,	
		37-40 ,,	10 ,,	
		41-44 ,,	11 ,,	
		45-48 ,,	12 ,,	
		49-52 ,,	13 ,,	
		53-56 ,,	14 ,,	
		57-60 ,,	15 ,,	

Contd...

1	2	3	4	5
2.	**BEAKER PROBLEM:**			
	Using one beaker	Four sub-process one mark each		15 Marks
	Using two beaker	Six sub-process one mark each		
	Using three beaker	Four sub-process one mark each		
	Using four beaker	One sub-process one mark each		
3.	**SEED PROBLEM :**			
	There are three factors with three possibilities in each factor.	3 x 9 = 27 combinations .55 mark for each combination		15 Marks
4.	**WORM PROBLEM :**			
	(Exclusion of variable problem in 3 steps)	5 marks in each step		15 Marks

Table No.11

Expected Performance for the Questions of Each Task, Their Level of Cognitive Development and Scoring

Task No.	Name of the task and expected performance	Level of cognitive development	Scoring
1	2	3	4
I.	**WAX PROBLEM :**		
	1. Predicts the variables	II A	1 Point

Contd...

1	2	3	4
	diameter of the rod & the material of the rod.		
	2. Predicts that the melting of the wax balls will depend upon the diameter and material of the rod.	II B	2 Point
	3. Predicts that the wax ball willnot melt faster than another rod (establishing relationship by pairing off) by keeping other factors constant when experimenting with a certain variable, e.g. keeping material on the rod constant when experimenting with rods of different diameter.	III	3 Point
	4. Predicts all the variable (material) and diameter of the rods) keeping all but one constant and testing one by one until all were tested.	IV	4 Point
II.	BENDING OF ROD PROBLEM:		
	1. Predicts the variables shape, diameter, length, material of the rod.	II A	1 Point
	2. Predicts that the bending of the rods will depend on its shape, diameter, length and material.	II B	2 Point

Contd...

1	2	3	4
	3. Predicts that one rod would not bend as much as another by keeping material, length constant when experimenting with the diameter or the effect of any other material.	III	3 Point
	4. Predict all the variable length, material, diameter keeping all but one constant.	IV	4 Point
III.	THE RAMPPROBELM :		
	1. Predicts the variables size of the balls, weight of the balls, angle of the ramps and surface of the ramps.	II A	1 Point
	2. Predicts that the movement of the target ball will depend upon the size of ball and weight of the balls, angle and surface of the ramps.	II B	2 Point
	3. Predicts that one target ball will not move as much as another when experimenting with one variable keeping the others constant.	III	3 Point
	4. Predicts all the variables size and weight of the balls, angle and surface of the ramps, keeping all but one constant.	IV	4 Point

Contd...

1	2	3	4
IV.	FLOW OF LIQUID THROUGH A TUBE:		
	1. Predicts the variables	II A	1 point
	2. Predicts that the flow of water depends on the variables. Level of water, length of the tube, diameter of the hole of the tube, etc.	II B	2 point
	3. Predicts that the flow of water through one glass tube will vary from another tube due to certain factors.	III	3 point
	4. Is able to isolate all the variables present by the method of varying single factor while holding all other constant. Only the causal factors are pointed out. Irrelevant factors are excluded.	IV	4 point
V.	PENDULUM PROBLEM:		
	1. Predict that the length of the string, weight of the bobs, size of the bobs can be varied.	II A	1 point
	2. Predicts that the time taken for the oscillation will depend upon the length of the string, weight and size of bobs.	II B	2 point

Contd...

1	2	3	4
	3. Separates out the factors when he is given combinations in which one of the factor varies while the other is kept constant.	III	3 Point
	4. Is able to isolate all of the variables present by the method of varying a single factor, while holding all other things being equal. Only the causal factor is pointed and other factors are excluded.	IV	4 Point

Classification of the Scores at different levels of intellectual development :

In accordance with the level of performance in each task the students are classified into four levels of intellectual development.

The following range of scores is used to categorise the students into concrete, transitional and formal operational stage for the stimulating problems :

Range of scores	Level of intellectual development
1 - 5	Early concrete operational stage.
6 - 10	Fully concrete operational stage.
11 - 15	Transitional stage.
16 - 20	Formal operational stage.

The number of points awarded for each level of performance in each task of the Pre-test, training sessions and Post-test are as follows ;

Level I	Preoperational stage	0 Point
Level II A	Early concrete operational stage.	1 Point
Level II B	Fully concrete operational stage.	2 Point
Level III	Transitional level	3 Point
Level IV	Formal operational stage	4 Point

The questions asked in each task are based on these various levels mentioned above. The correct answer for each level has been awarded a mark.

SELECTION OF THE SAMPLE

For selecting the samples of the study the investigator had to decide about the institutions from which the sample had to be drawn. Since the study was designed to have control and experimental groups, the first point kept in view while selecting the institutions was that there were

sufficient number of pupils in each grade so that they could be split into two equal groups. Thus, they could properly and accurately be matched against age, grade intelligence and socio-economic status.

Since the study consisted of a pre-test, three training sessions spaced at two-weeks duration each, and a post-test, it was also made sure that the institution finally chosen were such that maintained a good attendance record so as to avoid unnecessary drop-out.

As co-educational institutions were limited and hardly any of them fulfilled the above mentioned criterion, it was finally decided to select separate schools for boys and girls. It was, however, ensured that these had almost same level of teaching facilities, standard of education and had student population with similar socio-economic background.

The following three schools from Udaipur were chosen as these met the requirements of the study :

1. St.Pauls Higher Secondary School for boys
2. St.Mary's Convent High Secondary School for girls
3. St.Teresa Secondary School for girls.

After having chosen the institutions Raven's test of intelligence and a socio-economic status questionnaire were administered to the students in both the sections of each

grade (Vth to Xth) in each institution. On the basis of these tests the sample was selected. First of all, those students were located who had average intelligence and socio-economic status. Then, the students coming in this category from two sections of each class were matched against grade, age, intelligence and SES. In this way from each section of each grade about twenty students were selected. After this, one section from each grade constituted the control group while the other section made up the experimental group. The selection of the sections was randomly done. The following number of pupils were finally selected:

Table No. 12

Showing division and selection of the sample

Main Groups		CONTROL GROUP (160)		EXPERIMENTAL GROUP (160)	
Sub-Group		BOYS (80)	GIRLS (80)	BOYS (80)	GIRLS (80)
Grade	VII	20	20	20	20
	VIII	20	20	20	20
	IX	20	20	20	20
	X	20	20	20	20

The figure in bracket indicates the total number of subject selected for that group

Thus, in all there were 320 students finally selected for the study. The exact number actually chosen from each grade was a little more than the number required for the study. This was done in order to leave a sufficient margin for droup-outs at the various stages of the study.

STATISTICAL TECHNIQUES USED :

(1) Descriptive statistics like mean, median, standard deviation were calculated to know about the nature of the scores of different variables.

(2) The 't-test' was employed to find out the significance of difference between means related to different sub-groups of different variables.

(3) Pearson's product moment method of correlation was used for determining the relationship among the different variables.

(4) Faster analysis - Principal Axes method to find out the factorial structure underlying intelligence, personality traits and Post-test scores of of those students who were favourably influenced.

(5) Analysis of variance study the significant difference among the various groups in relation to the different modes of presentation for the various Piagetian Tasks.

(6) Chi-square to study the significant differences with the obtained results in pre-test and post-test and those which were expected theoritically on the hypothesis.

CHAPTER - IV

RESULTS OF DESCRIPTIVE STATISTICAL ANALYSIS, DISCUSSIONS AND CONCLUSIONS

INTRODUCTION :

The various tests relevant to the present study were administered and scored according to the procedures described in the previous chapter. The raw scores of all the variables for each student are presented in a tabular form in Appendix No.1.

In order to derive inherent facts and meaning from the raw scores, these were analysed and interpretations were made from different angles. The results of the descriptive statistics has been presented in terms of mean, standard deviation and frequency regarding the various measures included in this study before presenting the actual results related to the hypotheses. The main emphasis in this chapter is to analyse the responses on Raven's Progressive Matrix, H.S.P.O., Socio-economic status, stimulating problems, the pre test problems, three training sessions and the post test problems of the controlled and the experimental groups age wise, sex wise and grade wise, selected for this study.

ANALYSIS OF THE RESPONSES :

In this chapter only the descriptive statistics mean, standard deviation, frequency, percentage etc. are presented

and analysed for the variables selected in the present study. The mean, S.D. of the scores obtained by students at the three levels of intellectual development, personality, intelligence, socio-economic status sex wise, age wise, and grade wise for different Piagetian tasks during pre-test, training sessions and post test with regards to the performance on each problem among different groups are presented in the various tables given below.

LEVELS OF INTELLECTUAL DEVELOPMENT :

The scores for the levels of intellectual development of all the students were obtained using the five Piagetian tasks :

(a) Separation and control of variables
  i) Wax problem
  ii) Bending of rod problem
  iii) Ramp problem

(b) Exclusion of variables
  iv) Flow of liquid through a tube problem
  v) Simple pendulum problem

The raw scores for each problem and the total scores of each student is given in Appendix No. 1. The performance of the student in each question of the task, the attainment of concrete, transitional and formal operation stage in each task, the mean, S.D. of the five Piagetian task and the total

scores of all the Piagetian tasks for the groups of students at three levels of intellectual development, sex wise, age wise, grade wise and total sample wise is presented in table Nos. 13 to 24 respectively.

Number of boys, girls and the total sample present during the five Piagetian task :

The number of boys, girls and total sample in each task are presented in Table No.13. Total number of sample of boys of control groups from grade seventh to tenth is 77. Total number of sample of boys in experimental group is 71. The total number of boys involved in the study are 148. Total number of girls involved in control group and experimental group from grade VII to X are 75 and 75 respectively. Total number of girls involved in the study are 150. Total number of boys and girls involved in control group is 152 and number of students involved in experimental group are 146. In all 298 students were involved in this study. Initially, the sample theoritically taken into consideration was 320, twenty students from each section for each group. Since the total duration of the study for the total sample was wide spread, i.e., approximately six weeks, each training session after approximately two weeks in case of experimental group. There were some dropouts. Due to matched group selection these dropouts could not be replaced.

Table No.13

Number of boys, girls and the total sample of control and experimental group finally selected for the Pre-test and Post-test

			CONTROL GROUP						EXPERIMENTAL GROUP					
Sex	Grade	Age	Task$_1$	Task$_2$	Task$_3$	Task$_4$	Task$_5$	Total	Task$_1$	Task$_2$	Task$_3$	Task$_4$	Task$_5$	Total
BOYS	VII	11+	19	19	19	19	19	19	20	20	20	20	20	20
	VIII	12+	19	19	19	19	19	19	17	17	17	17	17	17
	IX	13+	19	19	19	19	19	19	17	17	17	17	17	17
	X	14+	20	20	20	20	20	20	17	17	17	17	17	17
								77						71
GIRLS	VII	11+	17	17	17	17	17	17	18	18	18	18	18	18
	VIII	12+	20	20	20	20	20	20	20	20	20	20	20	20
	IX	13+	20	20	20	20	20	20	17	17	17	17	17	17
	X	14+	18	18	18	18	18	18	20	20	20	20	20	20
								75						75

Total sample : Control group = 152

Experimental group = 146

GROUP SEXWISE	GRADE/ AGE	Level of I. D.	CONTROL GROUP						EXPERIMENTAL GROUP					
			Task 1	Task 2	Task 3	Task 4	Task 5	Total	Task 1	Task 2	Task 3	Task 4	Task 5	Total
BOYS.	VII 11+	C	19 (19)	18 (15)	19 (17)	19 (19)	19 (19)	16 (10)	19 (17)	18 (17)	19 (18)	19 (17)	18 (18)	9 (10)
		T	– –	1 (4)	– (2)	– –	– –	3 (9)	– (2)	1 (2)	– (1)	– (2)	– –	11 (13)
	VIII 12+	C	19 (18)	19 (19)	18 (17)	17 (16)	19 (19)	7 (9)	17 (17)	15 (17)	16 (17)	16 (17)	15 (17)	9 (4)
		T	– (1)	– –	1 (2)	1 (3)	– –	12 (10)	– –	2	1	1	1	8 (13)
	IX 13+	C	19 (18)	18 (15)	19 (18)	19 (16)	19 (19)	12 (8)	16 (16)	16 (16)	17 (16)	12 (17)	15 (10)	7 (–)
		T	– (1)	– (4)	– (3)	– (3)	– –	7 (11)	– (1)	1 (1)	– (1)	– –	– (1)	10 (7)
		F											– (6)	
	X 14+	C	19 (20)	16 (19)	17 (18)	18 (19)	20 (20)	14 (14)	17 (16)	16 (13)	17 (17)	17 (16)	17 (14)	8 (9)
		T	1	3 (1)	3 (2)	2 (1)	– –	6 (6)	– (1)	1 (4)	– –	– (1)	– (–)	9 (9)
		F											– (3)	
GIRLS	VII 11+	C	14 (14)	16 (13)	17 (17)	17 (17)	17 (16)	12 (0)	18 (7)	18 (13)	18 (15)	18 (15)	18 (16)	18 (9)
		T	3 (3)	1 (4)	– –	– –	– –	5 (7)	– (11)	– (5)	– (3)	– (3)	– –	– (9)
		F											– (2)	
	VIII 12+	C	20 (20)	19 (18)	20 (19)	20 (19)	20 (20)	13 (10)	20 (20)	20 (20)	20 (20)	20 (20)	20 (7)	10 (7)
		T	– –	1 (2)	– –	– –	8	7 (4)	–	–	–	–	– –	10 (13)
		F											– (13)	
	IX 13+	C	20 (20)	20 (20)	19 (20)	20 (20)	20 (20)	11 (17)	15 (15)	16 (14)	17 (15)	16 (17)	16 (13)	5 (4)
		T	– –	– –	1 –	– –		9 (3)	2 (2)	1 (3)	– (2)	1 –	1 –	12 (13)
		F											– (4)	
	X 14+	C	18 (14)	16 (15)	18 (16)	17 (15)	17 (17)	9 (9)	20 (19)	20 (18)	20 (19)	20 (20)	20 (8)	6 (5)
		T	– (4)	1 (3)	– (2)	– (2)	– (–)	9 (11)	– (1)	– (1)	– –	– –	– –	14 (12)
		F					– (1)			– (1)	– (1)		– (12)	– (1)

The figures in brackets denotes the number of students during the Post test

Numbers of boys at concrete, transitional and formal operational stage in each task at Pre-test for control and experimental group :

A total picture of the various intellectual level of boys as observed in each task for control and experimental group is seen in Table No.14. In task No.1 of control group 73 students are at concrete level, 4 students are at transitional level. None of the boys are at formal operational stage. In task No.2 of control group 73 students were at concrete level and 4 students were at transitional level.None of the boys were at formal operational stage. In task No.3, 73 students were at concrete level, 4 students were at transitional level. In task No.4,74 and 3 students were at concrete and transitional level of intellectual development. In task No.5,77 and 0 students were at concrete and transitional level of intellectual development. In total tasks, 49 and 28 students were at concrete and transitional level of intellectual development respectively.

In experimental groups for task No.1, it is seen that 71 students were at concrete level of intellectual development, none were at the formal level of thinking. So also the performance of students at different level for the second task was tabulated. 67 students and 4 students were at concrete and transitional level respectively. In task No.3, 90 students and 1 student were at concrete and transitional

level respectively. For task No.4, 69 students and 2 students were at concrete and transitional level. For task No.5, 71 students were at concrete level. For the performance of all the students in the total of the task 32 and 39 students were at concrete and transitional level respectively.

Number of boys at concrete, transitional and formal level in each task at post-test for control and experimental group :

For task No.1 of control group, 45 and 2 students are at concrete and transitional level respectively and for the experimental group, 66 and 5 students are at concrete and transitional level respectively. For task No.2, 73 students are at concrete level of intellectual development and 4 students are at transitional level respectively in the control group. Whereas in the experimental group, the number of students at concrete and transitional level for task No.2 are 67 and 4 respectively. In task No.3 of the control group, 68 and 9 students are at concrete and transitional level respectively and for experimental group, 69 and 2 students are at concrete and transitional level. In task No.4 for control group, 70 and 7 students are at concrete and transitional level and in experimental group, 68 and 3 students are at concrete and transitional level. For task No.5 in control group, 77 students are in concrete level whereas in experimental group, 61, 1 and 9 students are at concrete, transitional and formal operational level respectively. For the total of the tasks in control

group, 41 and 36 students are at concrete and transitional level and 23 and 48 students are at concrete and transitional level for the experimental group.

Number of girls at concrete, transitional and formal operational level of intellectual development at Pre-test for control and experimental group :

The total samples of girls finally selected for the study for both the control and the experimental group were identified in the concrete, transitional and formal operational levels of intellectual development. On categoriesing the control group on the basis of the raw scores, it was seen that 72 students were in the concrete stage and 3 students were in the transitional stage in task No.1. In task No.2, 72 and 3 students were in the concrete and transitional level respectively. In task No.3, 74 students were found to be in concrete level and 4 students were found to be in transitional level. In task No.4, 75 students belonged to concrete level. In task No.5, 75,students were found to be in concrete level. For the total of the tasks it was observed that 45 students were of concrete level and 30 students were of transitional level of intellectual development.

For the experimental group, according to the scoring in each task the students were categorised in the various levels of intellectual development. For task No.1, 73 students

and 2 students belonged to concrete and transitional level respectively. In task No.2, 73 students were of concrete level and 2 students belonged to the transitional level. For task No.3, 71 students were classified concrete level and 4 students transitional level. In task No.4, 74 students belonged to concrete level and 1 student belonged to the transitional level. In task No.5, 74 and 1 students belonged to the concrete and transitional level respectively. For the total of all the tasks, 36, 38 and 1 students belonged to concrete, transitional and formal levels of intellectual development.

Hence, it is seen that for control group the students belonged to only two levels of intellectual development, viz., concrete and transitional levels whereas in experimental group majority of the sample belonged to concrete and transitional levels but one student also scored marks of formal level.

Number of girls at concrete, transitional and formal operational level of intellectual development at Post test for both control and experimental group :

In order to have an exact picture of the results of the post test of only girls and to have a comparative view between the control and the experimental group, Table No.14 was composed. A detailed analysis is given below.

For control group, in task No.1 out of 75 number of students, 68 reached the concrete level of intellectual development and 7 reached the transitional level of intellectual development. In task No.2, 66 and 9 students reached the concrete and transitional level of intellectual development. In task No.3, 72 and 2 students were found to be in concrete and transitional level of intellectual development respectively. In task No.4, 73 students were found to be in concrete level and 2 students were found in transitional level. In task No.5, 71 students were in concrete, 4 students were in transitional and 1 student was found to be in formal operational levels. In total of the tasks, 50 students were in concrete level, 25 students were in transitional level and none were atthe formal operational level.

In experimental group, 61 students were at concrete level and 14 students were at transitional level in task No.1. In task No.2, 65 students were at concrete and 9 students were at transitional level and 1 student was at formal operational level. In task No.3, 69, 5 and 1 students were in concrete, transitional and formal operational level of intellectual development. For task No.4, 72 students were at concrete level while 3 students were at transitional level. In task No.5, 47 students were at concrete level and 28 students were at formal operational level of intellectual development. In the total of all the Piagetian tasks, 25 students were at

concrete stage, 49 students were at transitional stage and 1 student was at formal operational stage of intellectual development.

Hence, we see from the raw scores that the performance of experimental group of girls at the higher grades were much better than the control group scores of the Post test. Some of the students of the experimental group reached the formal operational stages which is not so in case of control group.

Number of boys of control group at concrete, transitional and formal operational level at pre-test and Post-test :

In order to draw a comparative picture of the intellectual level of the boys of control group for the pre-test and post-test, Table No.14 was composed. This table has been analysed in two ways. First a composite analysis of each task of each test and than comparison of each task with both the tests.

For pre-test in task No.1, 76 students reached the concrete level of intellectual development and 1 student was at transitional level. In task 2, 73 and 4 students were at concrete and transitional level of intellectual development, respectively. In task No.3, 73 and 4 students are at concrete and transitional level of intellectual development respectively. In task No.4, 74 students were at concrete level and 3 students

were at transitional level. In task No.5, 77 students were at concrete level. In the total of all the tasks 49 students were at concrete level and 28 students were at transitional level.

In the post-test in task No.1, 75 students were at concrete level and 2 students were at transitional level. In task No.2, 73 students were at concrete level and 4 students were at transitional level. In task No.3, 68 students were at concrete level and 9 students were at transitional level. In task No.4, 70 students were at concrete level and 7 students were at transitional level. In task No.5, 77 students were at concrete level. In the total of all the tasks 41 students were at concrete level and 36 students were at transitional level.

Now to draw a comparative picture of the performance of the sample in Pre-test and Post-test, task-wise. In task No.1 of pre-test, 76 students were at concrete level whereas 1 student was at transitional level. In Post-test for the same task 75 students were at concrete level whereas 2 students were at transitional level. Here we see that in general there has been an improvement in task No.1. With the exception of grade IX all other grade showed improvement. In the IX grade in Pre-test, 8 students were at concrete level whereas 11 students were at transitional level but in Post-test a decline is noted.

10 students are at concrete level and only 9 students are at transitional level.

In task No.2, 73 students are at concrete level and 4 students are at transitional level as observed in the Pre-test while in Post-test task No.2, 73 students are at concrete level and 4 students are at transitional level. So we see in all there has been no improvement in the performance of the students in this task. However, a decline is seen in the performance of the students of grade VIII and X. In grade VIII there were 8 and 11 students in the concrete and transitional level respectively for the Pre-tast and in Post-test the number of students at concrete and transitional level is 11 and 8 respectively. Similarly, in grade X for Pre-test we see that 12 students were at concrete level and 7 students were at transitional level, but in Post-test 14 students were at concrete level and only 6 students were at transitional level.

For task No.3 of Pre-test, 73 students were at concrete level and 4 students were at transitional level. For the performance of students on the same task of Post-test we see 68 students at concrete level and 9 students at transitional level. So there has been an improvement for the performance of students from Pre-test to Post-test. There has been a decline in the performance by the students of grade VIII, IX and X.

For task No.4 in the Pre-test 74 students are at concrete level and 3 students are at transitional level. The performance of the boys of the same group, same task but in Post-test 70 students are at concrete level and 7 students are at transitional level. A decline is seen in grade VIII and grade X. But in the over all effect there is seen as progress.

For task 5 in the Pre-test 77 students are at concrete level. In Post-test, on the same task 77 students are at concrete level. There is a decline in the performance of grade VIII.

Now in the total of all the tasks in Pre-test 49 students are at concrete level and 28 students are at transitional level. Whereas in the Post-test 41 students are at concrete level and 36 students are at transitional level. A decline is seen in grade VIII.

To conclude, it is seen that though the control group did not receive any training yet a very slight improvement is seen in various tasks for the various grade / age. The exact reason for this cannot be pointed out but some of the causes may be (1) maturation - the time duration between the first test (Pre-test) and the second test (Post-test) was about six weeks, (2) It may be also due to memory as the same test was repeated. (3) It could be the sharing of ideas due to the interactions between the control and experimental groups during the time gap between the Pre-test and the Post-test.

Number of boys of experimental group at concrete, transitional and formal operational level of intellectural development for Pre-test and Post-test:

After giving the Pre-test the experimental groups was subjected to three training sessions which were roughly each two weeks apart. After the third training session a Post-test was conducted. The performance in both the Pre-test and Post-test has been tabulated in Table No.14.

For Pre-test in task No.1, 71 students were in concrete level of intellectual development. In the Post-test in task No.1, 66 students were at concrete level and 5 students are at transitional level. There has been an improvement in each grade from Pre-test to Post-test.

For task No.2, Pre-test 67 students were at concrete level and 4 students are at transitional level. For task No.2 in Post-test 67 students were at concrete level and 4 students were at ttansitional level. There is seen an improvement in each grade from Pre-test to Post-test.

For task No.3 in Pre-test 70 studants were at concrete level and 1 student was at transitional level. In post-test for the same task 69 students remained in the concrete level and 2 students were able to reach the transitional level.

For task No.4 in Pre-test 69 students were at concrete level, 2 students were at transitional level. For Post-test in the same task 68 students were found at concrete level and 3 students were found to be in the transitional level. In grade VII there is seen a decline from Pre-test to Post-test.

For task No.5 in Pre-test 71 students were at concrete level. For the same task of the Post-test 61 students were at concrete level, 1 student at transitional level and 9 students were at formal level. There is seen a decline in the performance from Pre-test and Post-test by the students of VII grade. However, this is the only task in which the students were seen to attain the formal operational scheme of thought. Students of grade IX and X reached formal operational level of intellectual development.

For the total of all these tasks in Pre-test 32 students were at concrete level and 39 students were at transitional level. In the performance for the total of the task 23 students were at concrete level and 48 students were at transitional level. In the all over performance there is seen an improvement from Pre-test to Post-test in all the tasks except the third one.

Number of girls of experimental group at concrete, transitional and formal operational level of intellectual development at Pre-test and Post-test :

The girls of experimental group were subjected to three training sessions after Pre-test. After the third training session Post-test was administered. The level of intellectual development at which the girls were initially present and their final attainment is given in Table No. 14.

For the first task of the Pre-test 73 students were at concrete level and 2 students were at transitional level. For the same task of the Post-test 61 students were at concrete level and 14 students were at transitional level. This shows that there has been an improvement from Pre -test to Post-test. A decline was seen in grade VIII.

For the 2nd task of the Pre-test 73 students were at concrete level and 2 students were at transitional level. For the same task in the Post-test 65 students were at concrete level, 9 students were at transitional level and 1 student was at formal operational level. Decline is seen in grades VIII and X. The over all effect is seen that the students have progressed. Three students from IX grade and one student from grade X was able to reach the formal operational level.

For task No.3 in Pre-test 71 students were at concrete level and 4 students were at transitional level. In the same task in Post-test 69 students were at concrete level and 5 students were at transitional level and 1 student was at formal operational scheme of thought. There has been an

improvement in the performance by the students from Pre-test to Post-test, specially in grade VIII, IX and X.

For task 4 in Pre-test 74 students were at concrete level and 1 student was at transitional level. For the same task in the Post-test, 72 students were at concrete level and 3 students were at transitional level. There is a slight drop in grade IX.

For task 5 in Pre-test, 74 students were at concrete level and 1 student was at transitional level. For the Post-test 47 students were at concrete level and 28 students were at formal stage. There is an improvement in the performance.

For the total perfomance of Pre-test all the students in all the tasks 36 students were at concrete level, 38 students were at transitional level and 1 student was at the formal stage. For the total performance of all the students at Post-test, 25 students were at concrete level, 49 students at transitional level and 1 student was at formal operational level. In the over all performance of all the students there is seen a progress from the Pre-test to Post-test in each grade.

In the Pre-test it is seen that the highest scores were obtained by the students in task No.1 and least in task No.4. In the Post-test the maximum scores were obtained in task No.5. Students from grade IX and X were able to reach formal operational level in the Post-test. Formal operational stage was

also reached by X grade in task No.2 and task No.3 in the Post-test. In the Pre-test no student was able to reach the formal stage of intellectual development.

Number of girls of control group at concrete, transitional and formal operational stage at Pre-test and Post-test :

The performance of girls of control group at various stages of intellectual development was calculated according to the scores obtained by each of the student in each of the five tasks. This has been presented in a tabular form in Table No.14.

The performance of grils in the Pre-test for the first task was that 72 students were in concrete level and 3 students were in transitional level. The performance of the same students in same task for Post-test was 68 students were at concrete level and 7 students were at transitional level. A decline from Pre-test to Post-test is seen in grades VIII and IX.

In task No.2, 73 students were at concrete level and 2 students were at transitional level in the Pre-test. In the Post-test for the same task, 66 students were at concrete level and 9 students were at transitional level. A decline in the performance by the students of grade VIII and IX is seen.

For the performance of the students in Pre-test in task No.3 it is seen that 75 students were at concrete level. It is also seen that during Post-test for the same task, 73 students were at concrete level and 2 students were at transitional level. The over all performance shows a decline in this task specifically so in grades VII and IX.

In task 4 for the Pre-test it is seen that 75 students were at concrete level of intellectual development. Whereas for the Post-teat 73 students were at concrete level and 2 students were at transitional level. Decline is noted in grades VIII and IX.

For the task 5 in Pre-test 75 students were at concrete level. For the Post-test in the same task 71 students were at concrete level. 4 students were also seen to have reached the formal operational level of intellectural development. However, formal operational level was reached by 1 student of grade X.

For the total of all the tasks, it is seen that in Pre-test 45 students performed at concrete level and 30 students performed at transitional level. The performance by the same students for Post-test in the total of all the tasks were that 50 students were at concrete level and 25 students were at transitional level.

Hence an over all picture drawn is that there is no improvement in the Pre-test and Post-test scores of the con-

trol group-girls, except for the X grade where a slight improvement is noted.

Number of boys and girls at concrete, transitional and formal operational level at Pre-test of control group :

In order to see at what stages the students were present initially and the performance of the boys and girls in each task. The Table No.14 is presented.

In task No.1, 76 boys were at concrete level and 1 boy was at transitional level whereas 72 girls were at concrete level and 3 girls were at transitional level. In task No.2, 73 boys were at concrete level and 4 boys were at transitional level whereas 73 girls were at concrete level and 2 girls were at transitional level. In task No.3, 73 boys were at concrete level and 4 boys were at transitional level whereas 75 girls were at concrete level. In task No.4, 74 boys were at concrete level and 3 boys were at transitional level. For the same task, 75 girls were at concrete level. In task No.5, 77 boys were at concrete level. For the same task, 75 girls were at concrete level.

For the total of the task, 49 boys were at concrete level and 28 boys were at transitional level whereas 45 girls were at concrete level and 30 girls were at transitional level. The performance of boys was the highest in task No.3. The performance of girls was the highest in task No.2 i.e. the number of students at higher level of intellectual development.

In task No.1 the number of boys at transitional level was the least and at concrete level was the most. Hence their performance was the least in task No.1. In task No.4 the number of girls at transitional level was the least and most at concrete level. Hence the performance of girls in task No. 4 was the least as majority of the girls were at concrete level.

In the over all performance of each grade and each task class VIII was ahead of other grades. Whereas in case of girls grade X scored the most.

In task No.1 grade IX had the most number of students in transitional level. In task No.2 grade VIII performed better than other grades. In task 3, 4 and 5 again grade VIII was better than the rest.

For girls the performance of grade IX was the most in task No.1. In task No.2 again X grade was ahead of other grades. In task 3 grade X scored more than the other grades. In task 4 grade IX scored more than any other grade. In task No.5 the performance of girls of grade X was the highest in comparison to other grades.

Hence grade IX performed the highest in both the boys and girls group for task No.1.

In the total of all the tasks grade VIII scored the highest in boys whereas grade IX scored the highest in girls.

Number of boys and girls of control group at concrete, transitional and formal operational level at Post-test :

From this table we can compare at what stages of intellectual development were the boys and girls of control group at Post-test. This group was not subjected to any training. Also a comparison can be made in each task and each grade.

In task No.1, 75 boys were at concrete level and 2 boys were at transitional level. For the same task 68 girls were at concrete level and 7 girls were at transitional level. The lowest number of girls in transitional level is seen in grade VIII. Infact not a single student reached this level. Whereas the highest number of boys reaching transitional stage is grade VII, VIII and IX. The highest number of girls reaching transitional level is seen in grade X whereas in grade X in boys minimum number of boys reached transitional level.

In task No.2, 73 boys were at concrete level and 4 boys were at transitional level whereas in case of girls for the same task, 66 girls were at concrete level and 9 students were at transitional level of intellectual development. In grade IX highest number of boys reached the transitional level. This is also observed in case of girls. The highest number of girls reaching the transitional-level is also grade IX. In grade X (girls) one student, however, attained the formal

operational level of intellectual development. Not a simgle student was,however, able to reach this level in any grade. The lowest number of students at transitional level is noted in grade X in case of boys and grade VIII in case of girls.

The task No.3, in case of boys 68 students are in concrete level and 9 students are in transitional level. For the same task in case of girls, 73 girls were in concrete level and 2 girls were at transitional level of intellectural development. It is also seen that in grade IX in case of boys and girls highest number of students reached the transitional level. One student among girls in grade X reached to the formal operational level but not a single boy reached this level in any grade. The lowest students reaching transitional level is grade X in case of boys and grade VIII in case of girls.

In task No.4, 70 boys were in concrete level and 7 boys were in transitional level. In case of girls 23 students were in concrete level and 2 students were in transitional level. The highest number of students at transitional level in case of boys were VIII and IX. In case of girls grade IX and X were the highest in their number at transitional level. None of the students in eitherboys or girls group in any grades reached the formal operational level. In case of boys the lowest number of boys in transitional level was seen in grade X whereas it was so in grade VIII.

In task No.5 in case of boys 77 students were in concrete level. In case of girls, 73 students were in concrete level. One student was in formal operational level. In case of boys the highest level of intellectual development reached is transitional and the highest number of boys in this stage is seen in grade VII and VIII. In case of girls many students are seen to reach the formal operational level of intellectual development. This level was reached by a few students of grades VII, VIII, IX and X. The highest number of girls in this level is seen in grade X. The lowest number of students at transitional level in case of boys is seen in grade X.

For the total of all the five tasks in case of boys, 41 students were at concrete level and 36 students were at transitional level. In case of girls 50 girls were at concrete level and 25 students were at transitional level. Formal operational level was not reached by a single boy in any grade whereas it is seen so in grade X in case of girls. The lowest number of boys at transitional level is seen in grade X and in case of girls grade VII.

Number of girls and boys of experimental group at concrete, transitional and formal operational level during the Pre-test :

The experimental group was subjected to three training sessions. These sessions were carried on between the Pre-test

and the Post-test. Table No.14 was compiled in order to find out at what levels of intellectual development were the boys and girls present at Pre-test. And also to draw a comparative picture between the two groups viz., boys and girls, an attempt has also been made to find out the levels of intellectual development of each grade within the group and with the other group.

In task No.1 for boys, 71 students were at concrete level. In case of girls for the same task, 73 students were present at concrete level and 2 students were present at transitional level. Over all performance of the girls was better than the boys as 49.33 per cent of the girls were present at transitional level and 45.19 per cent of the boys were at transitional level. The largest number of students found in transitional level is in grade IX in both the cases - boys as well as girls. The lowest number of students present in transitional level is seen in grade X in case of boys and grade VII in case of girls.

In task No.2 in case of boys, 67 boys were at concrete level and 4 students were at transitional level. In case of girls 73 girls were at concrete level and 2 girls were present at transitional level. 50.64 per cent of boys were present at transitional level and 54.66 per cent of girls were present at transitional level. So this shows that the overall performance of girls were better than the boys. The largest number

of boys in transitional level is seen in grade IX and the largest number of girls in transitional level is found in grade X. In both the group the lowsest number of students at transitional level is seen in grade X for boys and grade VII for girls.

For task No.3 in case of boys, 70 students were present at concrete level. In case of girls for the same task 71 students were present at concrete level and 4 students were present at transitional level. 51.94 per cent of boys were found to be in transitional level and 50.66 per cent girls were found to be in transitional level. So we see that in this task the performance of boys was better than the girls, unlike the previous two tasks. The highest number of boys, gradewise, in transitional level is seen in grade IX. In case of girls grade IX and X. The lowest number of studants at transitional level is seen in grade VII in both the groups.

In the fourth task, 69 boys were at concrete level and 2 boys were at transitional level. 74 girls were present in concrete level and 1 girl was present at transitional level. In all 49.35 per cent boys were found in transitional level and 45.33 per cent girls were present in transitional level. Therefore, the overall performance of boys in this task is better than girls. The difference between the two groups is the most in this task as compared to the previous three tasks. The lowest number of students found at transitional level as

in grade X for boys and grade VII for girls. The largest number of students found in transtional level is grade IX in boys and grade IX and X in girls.

In task No.5, 71 boys were present in concrete level. 74 girls were present in concrete level and 1 girl was present in transitional level. Hence, 50.64 per cent boys were found to be in transitional level and 48.00 per cent girls were in transitional level. Therefore, the performance of boys with respect to number of students was better than the girls. The highest number of boys in transitional level is seen in grade VII whereas the lowest number of girls at transitional level is seen in this grade i.e. VII. The largest number of students at transitional level for girls is in grade X. The lowest in case of boys is in grade VIII.

In the total of all the tasks, 32 boys were at concrete level and 39 boys were at transitional level whereas 36 girls were at concrete level and 38 girls were at transitional level, and 1 girl was at formal operational level. In all 51.94 per cent boys were at transitional level and 50.66 per cent of girls were at transitional level. Hence, in the total performance of all the tasks, the boys were better than the girls. The lowest number of students at transitional level in case of boys in grade VIII and in case of girls grade VII. The highest number of students at transitional level in case of boys is

in grade VII and IX and in case of girls is IX and X. One girl of grade IX reached the formal operational level of intellectual development.

Number of boys and girls of experimental group at concrete, transitional and formal operational level at Post-test :

After the three training session Post-test was administered on both the groups of experimental sample. The difference in the performance of these two groups during post-test is seen in Table No.14. A comparative picture is also drawn among each grade age-wise within the groups and with the other groups.

For task No.1 in case of boys 65 students were at concrete level and 5 students were at transitional level. In case of girls for the same task, 61 students were at concrete level and 14 students were at transitional level. Hence, 7.04 per cent boys were able to reach the transitional level whereas only 18.66 per cent of girls reached the transitional level. The weakest performance was shown by boys of grade X and girls of grade VIII. The best performance was shown by boys of grade IX and girls also of grade IX.

In task No.2, 67 boys were at concrete level and 4 boys were at transitional level. For the same task, 65 girls were at concrete level and 9 girls were at transitional level and

4 girls were at formal operational level. This shows that 5.63 per cent boys reached the transitional level and 12 per cent girls reached the transitional level. One girl reached the formal operational level whereas not a single boy was able to attain that level. In both the cases in grade IX the highest number of students were found in the transitional level. In case of boys there were 17 students considered for the study and all 17 were in transitional level. The lowest number of students in the transitional level was found in grade X of boys and grade VIII in girls.

For task No.3, 69 boys were at concrete level and 2 boys were at transitional level. 69 girls were at concrete level, 5 girls were at transitional level and 1 girl was at formal operational level. In all 3.81 per cent boys were at transitional level, and 6.66 per cent girls were at transitional level. So the performance of girls in this task was better than the boys. In grade IX in both the cases maximum number of students are in transitional level. The lowest number of students at transitional level in case of boys in grade VII and in case of girls grade VIII.

For task No.4, 68 boys were at concrete level, 3 boys were at transitional level, 72 girls were at concrete level and 3 girls were at transitional level. In all 4.22 per cent boys were at transitional level.and 4 per cent girls were at transitional level. Hence, the performance of boys in this task was

better than the girls. The highest number of students present in transitional level in case of boys in grade IX and in case of girls in grade IX and X. The lowest number of students present in transitional level in case of boys is seen in grade VII and in case of girls grade is VIII. No a single student however, reached the formal operational scheme of thought in either group.

For task No.5, 61 boys were at concrete level, 1 boy was at transitional level and 9 boys were at formal operational level. For the same task, 47 girls were at concrete level, 28 students were at formal operational level. In all 12.67 per cent boys were at formal operational level, 1.40 per cent boys were at transitional level. On the other hand, 37.33 per cent girls were at formal operational level. Hence, for this task, the performance of girls was much better than the boys. In all the performance of both the groups is seen the best for this task as compared to other tasks. The lowest number of students at transitional level in case of boys is seen in grade VII. The highest number of students at formal operational level is seen in grade IX in case of boys and in grade X in case of girls.

For the total of all the tasks, 23 boys were at concrete level, 48 boys were at transitional level. 25 girls were at concrete level, 49 girls were at transitional level and 1 girl

was at formal operational level. The performance of girls in the total tasks was better than the boys. Grade IX in girls and also grade IX in boys performed better than any other grade within the group. As compared to these other grades, grade VII of boys and grade VII of girls were at the tail end. Thus, 67.60 per cent boys were found to be in transitional level, 1.33 per cent girls were found in the formal level and 65.33 per cent girls were found to be in the transitional level.

To sum it all, it is seen that the performance of Post-test for both the groups - the control and the experimental - is better than the Pre-test. Though the performance of experimental group at the Post-test is much better than the control group. There is seen great fluctuations for the various tasks at the three levels of intellectual development, yet it is seen that the higher grades excelled the lower ones.

Sex wise the performance of boys is better than the girls for almost all tasks except the fifth task in which the girls had a upper hand. Yet for the second and third problem only a few girls reached the formal operational level during the Post-test in the experimental group but not a single boy was able to do so.

Grade wise too, it is seen that the performance of the higher grades in the Pre-test and Post-test of control and experimental group is better than the lower grade. In both

the groups girls performed better at the ninth and tenth grade. for all the tasks. After training, larger number of girls reached the formal level. In case of boys the ninth grade seems to be better in performance than the tenth grade. A few number of them, however, reached the formal level.

Similarly, age-wise, the higher age group performed better than the lower age group. This was seen for both the control and the experimental group of boys and girls. This difference is seen in the Pre-test and the Post-test.

As stated earlier, four models of presentation were used during the training session in this study. Training was imparted only to the experimental group. It is seen from the table that the performance of the students were better for the fifth task, that was the simple Pendulum Problem. The mode of presentation for this problem was such that the student experimented by themselves by handling the apparatus. They worked according to the various variables, keeping all but one constant till they were able to isolate the irrelevant variables and thus pointing out the causative variable.

Analysis of Table No.15 showing the mean and standard deviation of each task and total scores for the Pre-test of boys and girls at different levels of intellectual development for both control and experimental groups :

In order to find out the mean and standard deviation of both the experimental and the control group for boys and girls,

Table No.15

MEAN, STANDARD DEVIATION OF EACH TASK SCORES FOR THE PRE TEST AND THE POST TEST OF BOYS AND GIRLS AT DIFFERENT LEVEL OF INTELLECTUAL DEVELOPMENT

Stage of intellectual development	Range Total scores	Test	Total number of studs.	CONTROL GROUP						Total number of students	EXPERIMENTAL GROUP					
				Task 1	Task 2	Task 3	Task 4	Task 5	Total		Task 1	Task 2	Task 3	Task 4	Task 5	Total
B O Y S																
CONCRETE	1-7	Pre	49	1.276 (9.452)	1.380 (0.532)	1.4520 (0.501)	1.2972 (0.489)	1.337 (0.476)	5.489 (0.793)	32	1.451 (0.528)	1.522 (0.503)	1.544 (0.501)	1.507 (0.503)	1.478 (0.606)	5.531 (0.841)
		Post	41	1.4 (0.493)	1.342 (0.532)	1.367 (0.485)	1.357 (0.482)	1.363 (0.484)	5.536 (0.809)	23	1.651 (0.480)	1.656 (0.478)	1.565 (0.499)	1.617 (0.489)	1.373 (0.531)	5.347 (0.572)
TRANSITIONAL	8-14	Pre	28	3 (0)	3 (0)	3 (0)	3 (0)	-	9.535 (0.874)	39	-	3 (0)	3 (0)	3 (0)	-	9.410 (0.938)
		Post	36	3 (0)	3 (0)	3 (0)	3 (0)	-	9.583 (1.401)	48	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)	10.25 (1.263)
FORMAL	15-20	Pre													4 (0)	
		Post														
Girls																
CONCRETE	1-7	Pre	45	1.333 (0.474)	1.388 (0.518)	1.311 (0.465)	1.306 (0.488)	1.400 (0.519)	5.444 (0.724)	36	1.479 (0.503)	1.544 (0.502)	1.363 (0.509)	1.459 (0.501)	1.472 (0.502)	5.305 (0.576)
		Post	50	1.363 (0.481)	1.348 (0.480)	1.246 (0.464)	1.246 (0.464)	1.225 (0.453)	5.48 (0.862)	25	1.377 (0.488)	1.322 (0.471)	1.304 (0.463)	1.333 (0.474)	1.255 (0.441)	5.52 (0.822)
TRANSITIONAL	8-14	Pre	30	3 (0)	3 (0)	3 (0)	-	-	9.066 (0.868)	38	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)	9.631 (0.713)
		Post	25	3 (0)	3 (0)	3 (0)	3 (0)	-	9.527 (1.242)	49	3 (0)	3 (0)	3 (0)	3 (0)	-	9.836 (1.940)
FORMAL	15-20	Pre								1						15 (0)
		Post							4 (0)	1		4 (0)	4 (0)	-	4 (0)	17 (0)

Figures in brakets represent the S.D. values

the following table is analysed, according to the level of intellectual development of the total sample in each group.

The procedure of scoring has been described in chapter - III for each task. One mark was awarded for each level of intellectual development. For the total scores the marks for each task was added up and the range of marks divided equally into three in accordance with the number of stages of intellectual development looked for in the study.

The means of each task of control and experimental group of boys and girls show a similarity. This also holds good for the total scores of all the tasks. Not much difference is seen in transitional level of boys and girls for control and experimental group. This has been observed for each task and the total scores of all the tasks. Though there is observed a slight difference in the total scores. The boys of control group secured marks less than the experimental group of boys. The performance of boys of control group was better than the control group of girls. But the performance of girls in experimental group is better than the boys of experimental group. It is also seen that only a very few number of girls were at formal level in both the experimental and the control group. However, for the boys groups, not a single student was found in this higher intellectual development level.

When coming to the values of standard deviation of each task and the total scores of all the task, out of 44 standard

deviation computed, none was greater than one. This indicates that the groups, in term of total performance on Piagetian task are more or less homogenous.

Mean, standard deviation of scores of each task for the Post-test of boys and girls and total sample at different level of intellectual development :

The means of each task of control and experimental group of boys and girls show a similarity. This shows that the performance of the groups is homogenous. This is the case for concrete and transitional level. Few reached the formal operational level in experimental boys group as seen only for task 5. So is also the case in girls for both the control and the experimental group. In experimental group, girls did reach the formal level for tasks 3 and 5. In the total means of all the task there is observed a slight difference in the performance of the students belonging to transitional level. In case of boys and girls experimental group the performance was better than both the sex group of control group. In all, according to the means of boys and girls in both the experimental and control group, the performance of girls is better than boys. It is also seen that a homogenity is mentioned in both the experimental and the control group of boys and girls for each task, when considered separately.

When seeing the values of standard deviation in each task, out of 50 standard deviation computed, 4 values were

were above one. This indicates that the performance of students for most of the task of both the groups are more or less homogenous. Also, the performance on the total of all the tasks, at transitional level, for both the groups, the experimental and the control group, in both the cases of boys and girls show maximum heterogenity. Greater variation is observed in the experimental group than the control group of boys and girls.

Mean, standard deviation of each task and total of all the tasks for the Pre-test and Post-test of boys and girls of control group at different levels of intellectual development :

The means of each task of Pre-test of both boys and girls show a homogenity. This shows that both groups of boys and girls were almost similar as far as the performance of the students are concerned. Also the performance within the group for each task shows a homogenous trend when seeing the total of the tasks, the means indicate that the performance of boys is better than the girls in Pre-test.

Seeing the means of Post-test for both the groups of boys and girls, there is seen a homogenity in both the groups in the performance of students at each task, at the concrete and transitional level. When seeing the mean of the total of all the scores, there is seen a variation in the means. The performance of girls is better than the boys.

Seeing the means within each group of Pre and Post-test not much variation is seen for each task. In the total of performance of boys there is seen an increase in the transitional level of Pre and Post-test. That means more students previously at the concrete level was into the transitional level.

For girls group the means show a homogenous trend for each task at concrete and transitional level for both Pre and Post-test. However, a difference is seen in transitional level. For each task when compared the performance of girls in Post-test was better than in Pre-test. Seeing the means of the all the tasks, there is again a fluctuation. The means of Post-test was slightly more than the means of Pre-test. This indicates that the performance of girls at Post-test is better than the Pre-test.

Seeing the values of standard deviations out of 44 values computed 2 were more than one. All these three belong to the total of all the tasks. This indicates that most of the group, in term of performance in each task at Pre-test and Post-test, are more or less homogenous.

Mean, standard deviation of each task and total scores of Pre-test and Post-test of experimental group at different levels of intellectual development :

The means as indicated from Table No.14 shows a homogenous trend in each task of concrete level for boys and girls

in Pre-test as well as Post-test. There is however, seen a decline in the concrete level from Pre-test to Post-test in boys. There is seen an increase in the means of the total scores from Pre-test to Post-test in case of boys,again this is an expected findings.

The means on the performance of girls is homogenous for each task in the total of all the scores, there is a decline from Pre-test to Post-test at concrete level and an increase in the means at the total scores. This indicates that the performance of girls is better at Post-test than in Pre-test.

The mean of Pre-test of each task for boys and girls indicates that in task No.1 and 3, the performance is better than boys. The means of total performance indicate that the concrete level and transitional level boys performed slightly better than girls. But the performance at Post-test when looking at the means shows that for each task the girls performed better than the boys. The means of the total also shows that the performance of girls is better than boys.

Level of intelligence, range of scores, their means and standard deviation :

From each grade students were matched against intelligence. Raven's Progressive Matrix was used to find out the scores of intelligence. The students falling on both the extreme ends, that is, whose scores were very high or very low

Table No. 16

Intelligence : Score, mean and standard deviation
of the sample selected for the study

Group	Sex	Level of Intelligence	Range	Mean	Standard deviation
CONTROL	Boys	High	57 - 52	53.692	1.601
	Boys	Average	51 - 42	47.839	2.794
	Boys	Low	41 - 37	39.000	1.690
	Girls	High	57 - 47		2.449
	Girls	Average	46 - 26	39.818	5.117
	Girls	Low	25 - 15	21.666	5.773
EXPERIMENTAL	Boys	High	57 - 52	54.230	2.006
	Boys	Average	51 - 42	45.612	2.564
	Boys	Low	41 - 37	39.111	1.615
	Girls	High	57 - 47	52.285	2.830
	Girls	Average	46 - 26	38.04	5.778
	Girls	Low	25 - 15	22.25	4.856

were excluded from the study. Then it was ensured that the range of scores were similar within a grade and age for both the control and the experimental group. On the basis of the scores of the total sample the mean and standard deviations was computed for control and experimental group of boys and girls.

The range of intelligence of boys was from 57 to 37 and for girls this range was from 57 to 15. The range of scores was wide, hence each group was divided into three level - high, average and low. Seeing there level differently the range of high intelligence of boys is from 57 to 52 and for girls it is from 57 to 47. The range of average intelligence of boys is from 51 to 42 and in case of girls it is from 46 to 26. The low range of scores of boys is from 41 to 37 and of girls from 25 to 15.

When looking at the mean there is seen variations. This shows that the group selected in this study is of a heterogenous nature.

The value of S.D. also indicate the heterogenity of the group. 12 standard deviation were computed and all these standard deviation were more than one.

Table No. 17

Socio-Economic status, its mean and standard deviation of the sample selected

Group	Sex	Level of Socio-Economic status	Range	Mean	Standard deviation
CONTROL	Boys	High	23 - 20	21.0416	0.8586
	Boys	Average	19 - 17	18.2058	0.7443
	Boys	Low	16 - 13	15.3076	0.9281
	Girls	High	26 - 19	20.3636	1.6548
	Girls	Average	18 - 16	16.8360	0.7995
	Girls	Low	15 - 12	14.0952	0.9952
EXPERIMENTAL	Boys	High	24 - 20	21.0312	1.2568
	Boys	Average	19 - 17	17.7547	0.7571
	Boys	Low	16 - 14	15.4800	0.7141
	Girls	High	25 - 19	20.1724	1.8721
	Girls	Average	18 - 16	17.0166	0.8334
	Girls	Low	15 - 12	14.2400	0.7788

Socio-economic status, its mean, and standard deviation of the entire sample for control and experimental group:

While selecting the sample it was kept in mind that the students of both the group, boys and girls, are almost equal in level of socio-economic status. After selecting the schools - three in all from Udaipur local schools - the tests was conducted. The details of the test, its scoring procedure is explained in chapter - III. Both the groups were matched. On the basis of the scores obtained those students were excluded from the study who scored either very high or very low. Those students clustering on an average were selected for the study. The pupils selected within grades and age-were those having similar scores in control and experimental group.

The total range of socio-economic status of boys for both the control and the experimental group was from 24 to 12. The total range of socio-economic status of girls was from 26 to 12. The range of each group was further divided into high, low and average. The range of socio-economic status on higher side for boys was from 24 to 20 and of girls from 26 to 19. The average range of boys was from 19 to 17 and of girls was from 18 to 16. The low average of boys was from 16 to 13 and of girls from 15 to 12.

When looking at the mean not much variation is seen. This shows that the group selected was of a homogenous group. This is also seen in the values of standard deviation. Out of

12 standard deviation computed the value of three standard deviation is more than one. All these values greater than one belongs to the higher level. One for the group of boys and 2 for the group of girls. This indicates that the group is more or less a homogenous one.

Personality factors, its mean and standard deviation of the entire sample for control and experimental group:

Students of each grade after being matched against age, intelligence and socio-economic status were given the H.S.P.Q. test to find out the various personality factors sex-wise of the entire population.

The means as indicated from Table No.17 for each factor of boys shows a homogenous trend. The means varied between 5.9818 to 4.6036. The means observed for factors A, C, D, F, G, H, O, Q_3 and Q_4 were slightly more than that observed for factors B, E, I, J and Q_2.

Similarly for girls for factors D, F, Q_4 showed a higher mean than factors A, G, I, Q_2. Factors B, C, E, H, J, O, Q_3 showed a slight difference in the both the groups.

Seeing the values of standard deviation out of 56 values computed only one value was less than one. The other values were more than one which indicates that the groups in terms of performance for each factor are not homogenous.

Table No.17

Personality Factors, Its Mean and Standard Deviation of The Entire Sample For Control And Experimental Group

GROUPS	A	B	C	D	E	F	G	H	I	J	O	Q_2	Q_3	Q_4
	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
CONTROL BOYS	5.5811	4.7179	5.6153	5.4017	4.7711	5.2352	5.0090	5.1880	4.808	4.9745	5.6134	4.7796	5.3760	5.0854
	(1.5549)	(1.5583)	(1.8281)	(1.5203)	(1.7067)	(1.8897)	(3.0635)	(1.5431)	(1.9596)	(1.8043)	(1.8231)	(1.5966)	(1.9241)	(1.4237)
EXPERIMENTAL BOYS	5.7927	4.8268	5.4864	5.4954	4.9090	5.2018	4.7657	5.3303	4.6036	4.6306	5.4864	4.9292	5.3513	5.9818
	(1.5673)	(1.6285)	(1.8033)	(1.7470)	(1.5770)	(4.3711)	(1.4829)	(1.5444)	(.6364)	(1.8825)	(1.7418)	(1.7561)	(1.7302)	(7.8459)
CONTROL GIRLS	4.6315	4.8717	5.4224	5.9646	4.8684	5.5304	3.8521	5.2608	4.5128	5.3716	6.8684	4.7913	6.2456	5.8793
	(1.4283)	(1.4944)	(1.9208)	(1.6252)	(4.0972)	(1.6770)	(1.4341)	(1.8829)	(1.8223)	(7.9047)	(9.8892)	(0)	(8.7689)	(2.1595)
EXPERIMENTAL GIRLS	4.7304	5.4310	4.8196	5.7565	5	5.5565	3.2608	4.2	4.5689	4.5363	4.7368	4.7565	4.5826	5.7043
	(1.7884)	(1.7356)	(1.5794)	(1.6254)	(1.6490)	(2.0312)	(1.2641)	(1.6340)	(1.6430)	(5.0820)	(1.8769)	(2.1948)	(1.7319)	(1.7470)

Table No. 19

THE PERFORMANCE OF BOYS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS

GRADE	Int. Dev.	IST TRAINING						IIND TRAINING						IIIRD TRAINING					
		1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Tota.
VII	C	1	1	2	4	7	-	1	2	2	5	8	3	1	1	3	4	7	1
	T	16	19	9	12	13	17	16	18	10	10	12	15	17	19	5	10	13	16
	F	3	-	9	4	-	3	-	-	8	5	-	2	2	-	12	6	-	3
VIII	C	-	1	1	-	3	-	-	1	-	-	1	3	-	-	-	-	-	-
	T	15	16	7	12	14	10	16	16	5	8	16	6	13	17	5	7	17	7
	F	2	-	9	5	-	7	1	-	12	9	-	8	4	-	12	10	-	10
IX	C	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
	T	16	17	7	13	17	13	11	17	2	7	17	4	9	17	3	3	17	3
	F	1	-	10	4	-	4	6	-	15	9	-	13	8	-	14	14	-	14
X	C	2	-	3	1	-	-	2	1	1	1	1	1	1	1	1	1	1	1
	T	13	17	4	10	17	12	9	16	3	3	16	1	1	16	1	2	16	2
	F	2	-	10	6	-	5	6	-	13	13	-	15	15	-	15	14	-	14

The performance of boys at the three levels of intellectual development during the three training sessions :

Training was given only to the experimental group after the pre-test. There were three sessions conducted in all for each grade. These training sessions were spaced at an interval of approximately two weeks each. Immediately after the third session, Post-test was administered. The procedure of scoring for each training session was the same. Each problem had a number of processes, each depending upon the variables effecting the problems. Each step carried equal marks. These marks were divided according to the level of intellectual development.

In the first problem 3 students were present at concrete level for the first training session, 3 in the second training session and 2 in the third training session. The number of boys at transitional level were 60 in first training session, 52 in the second training session and 40 in the third training session. The number of boys at the formal operational level is 8 in first training session, 13 in the second training session and 29 in the third training session. Here we see that for the first problem there is a gradual improvement from first training to the third training. This is an expected finding.

For the 2nd problem the number of boys at concrete level is 2 in the first training session, 4 at the second training

session and 2 at third training session. The number of boys at transitional level is 50 in the first training session, 67 in the second training session and 69 in the third training session. The number of boys at formal operational level in first training session is 0, in the second training session 0 and in the third training session is 0. In this problem for the concrete level there is seen a decline in the third training session. There is seen a progress from the first to third training session for the transitional level. There is no student in the third stage of intellectual development from first to third training session. There is seen an improvement from the concrete to the formal stage.

For the third problem the number of boys at concrete level is 6 in the first training session, 3 in the second training session and 4 in the third training session. The number of boys at transitional level in first training session is 27, in the second training session 18, and in the third training session 14. The number of boys at formal stage in the first training session is 38, in the second training session 48 and in the third training session 53. Here we see there is a progress in the performance of boys in the concrete and transitional levels. There is, however, seen a improvement in the performance of boys at formal stage from the concrete stage. Hence in all there is a progress from concrete to formal stage.

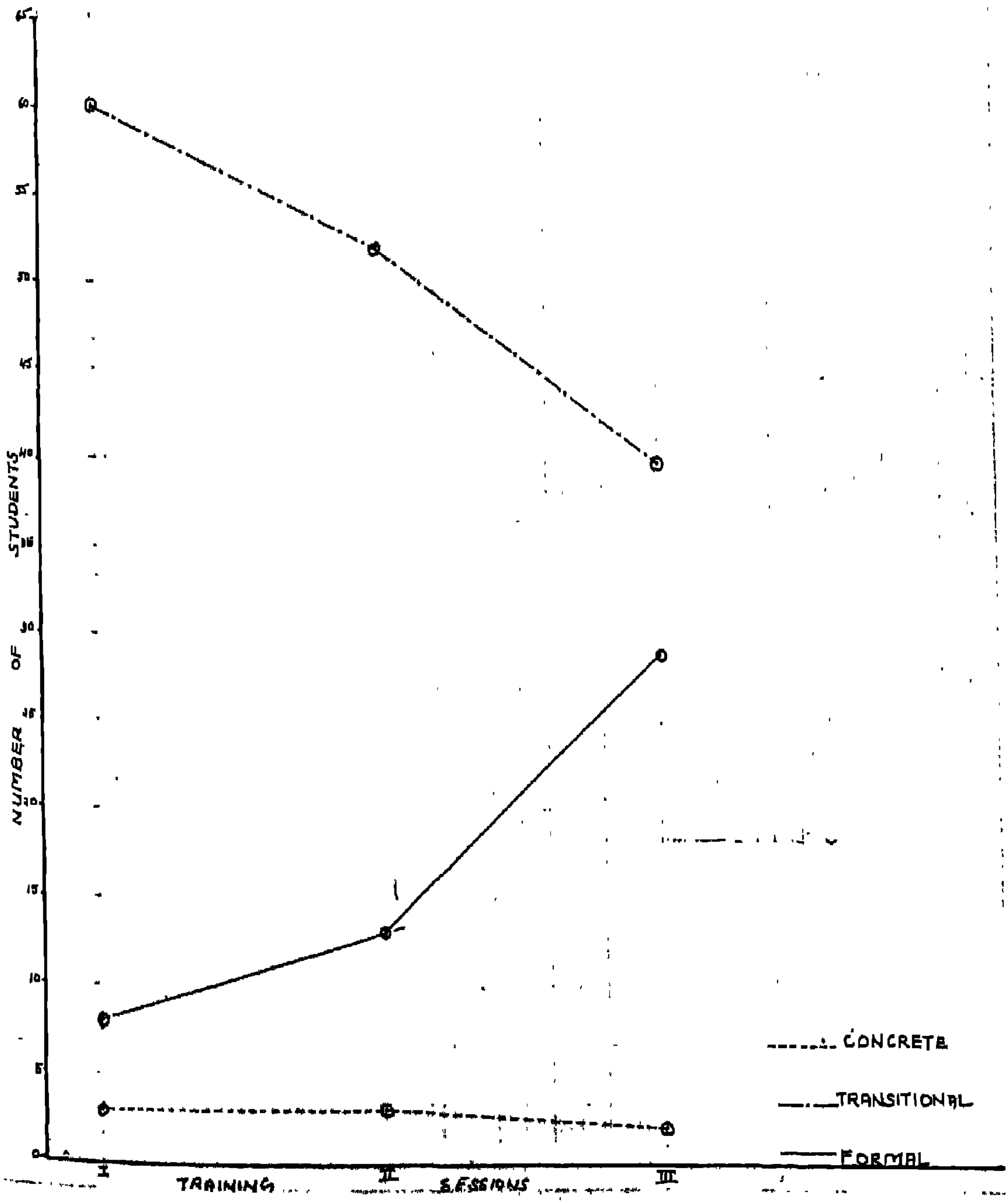
For the fourth problem the number of boys present in concrete level during the first training session is 5, during the second training session 7 and during the third training session 5. The number of students at transitional level is 47 in the first training session, 28 in the second training session and 22 in the third training session. The number of students at formal stage of intellectual development is 14 in the first training session, 36 in the second training session and 44 in the third training session. Here it is seen that there is a progress from concrete to formal stage.

For the fifth problem the number of students at concrete level is 10 in the first training session, 10 in the second training session and 8 in the third training session. In the second training session there is seen a slight decline but there is a progress in the third training session. The number of students in the transitional level is 61 in.the first training session, 61 in the second training session and 63 in the third training session. Here there is seen a progress in the performance of the students from first training session to the third training session. No student, however, reached the formal stage in any of the training session.

For the total of all the tasks, the number of students at concrete level is 0 in the first training session, 7 in second training session and 2 in third training session.There is seen a decline in the second training session. There is,

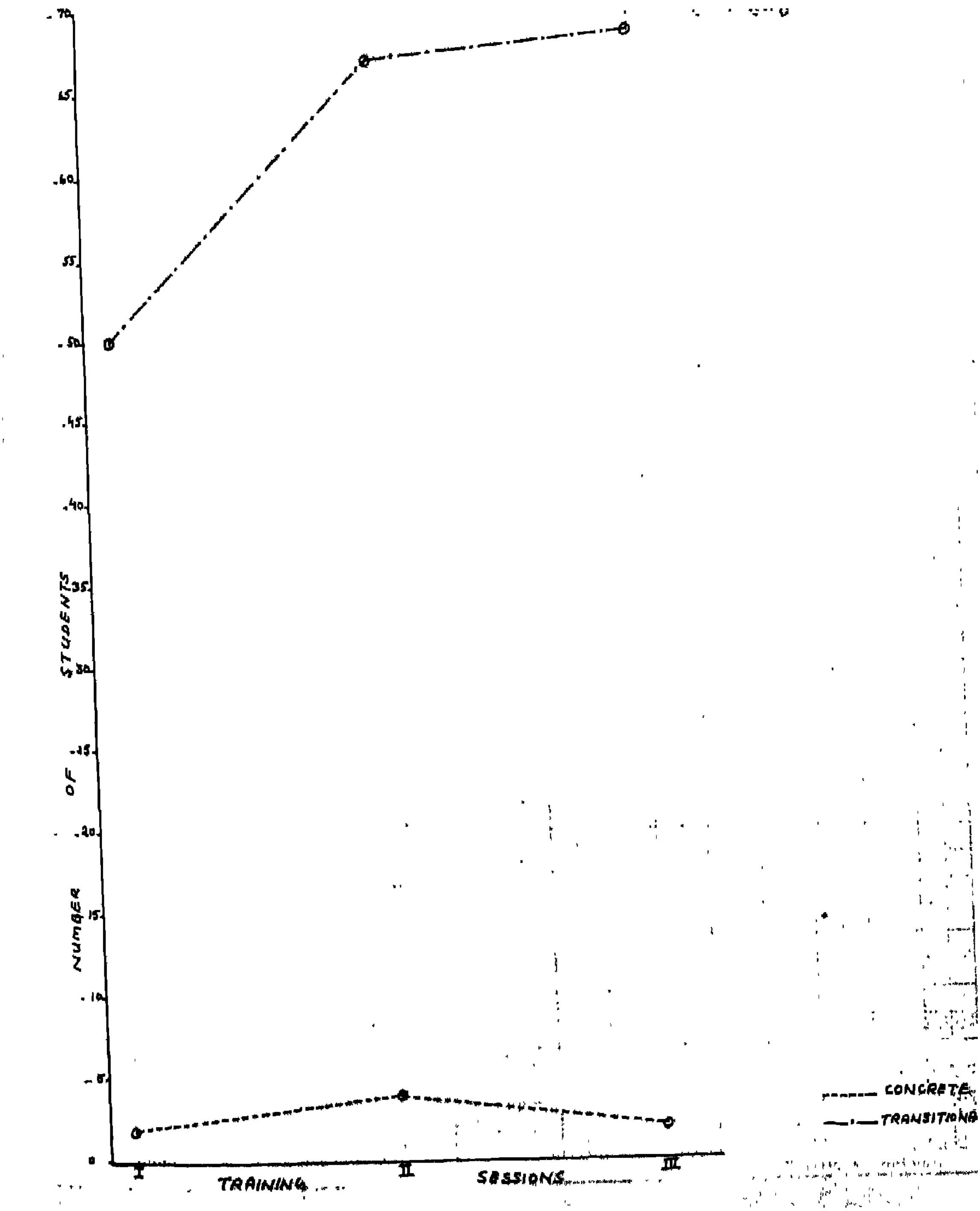
PERFORMANCE OF BOYS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM I.



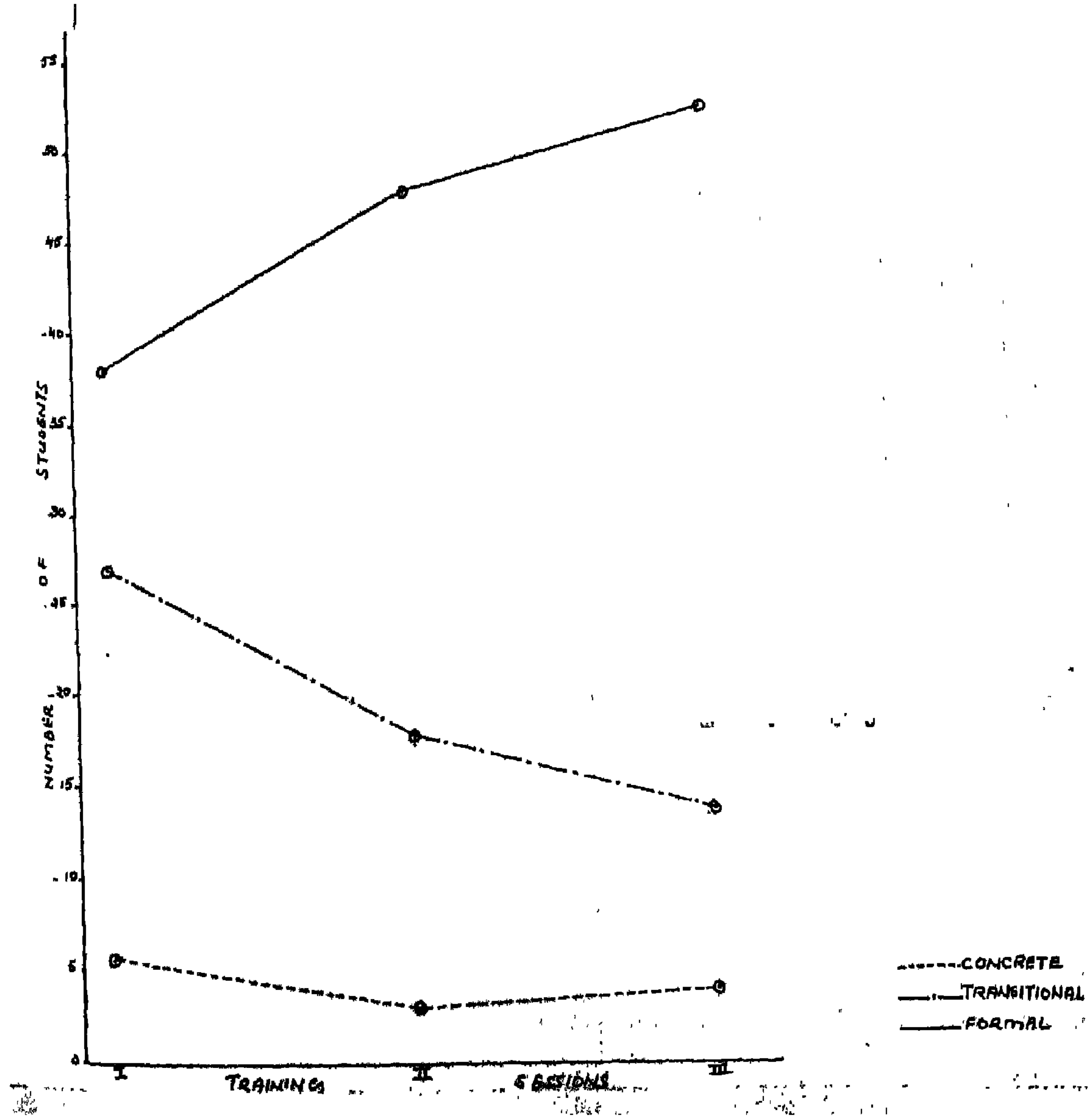
PERFORMANCE OF BOYS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM -2.



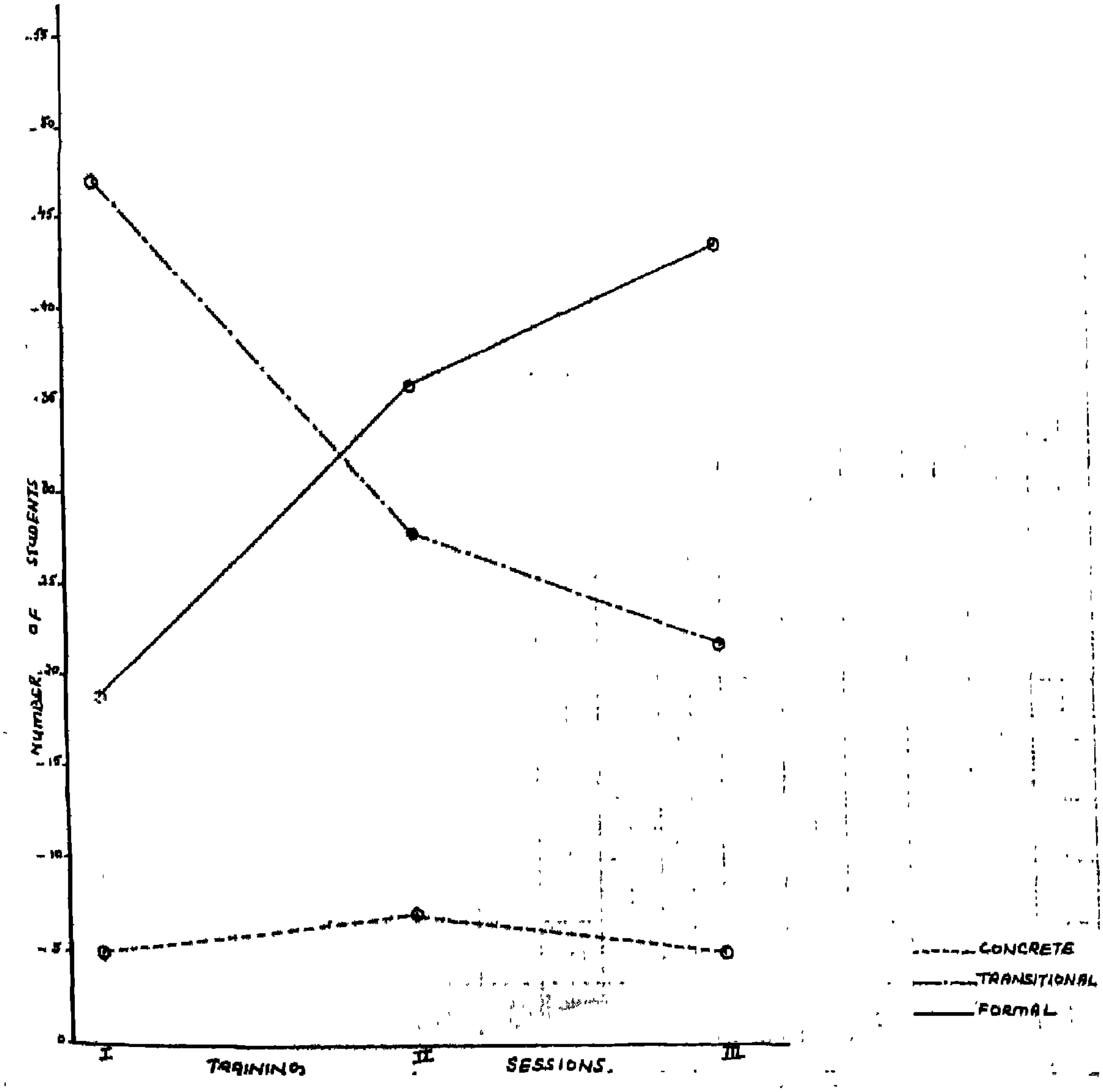
PERFORMANCE OF BOYS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM - 3.



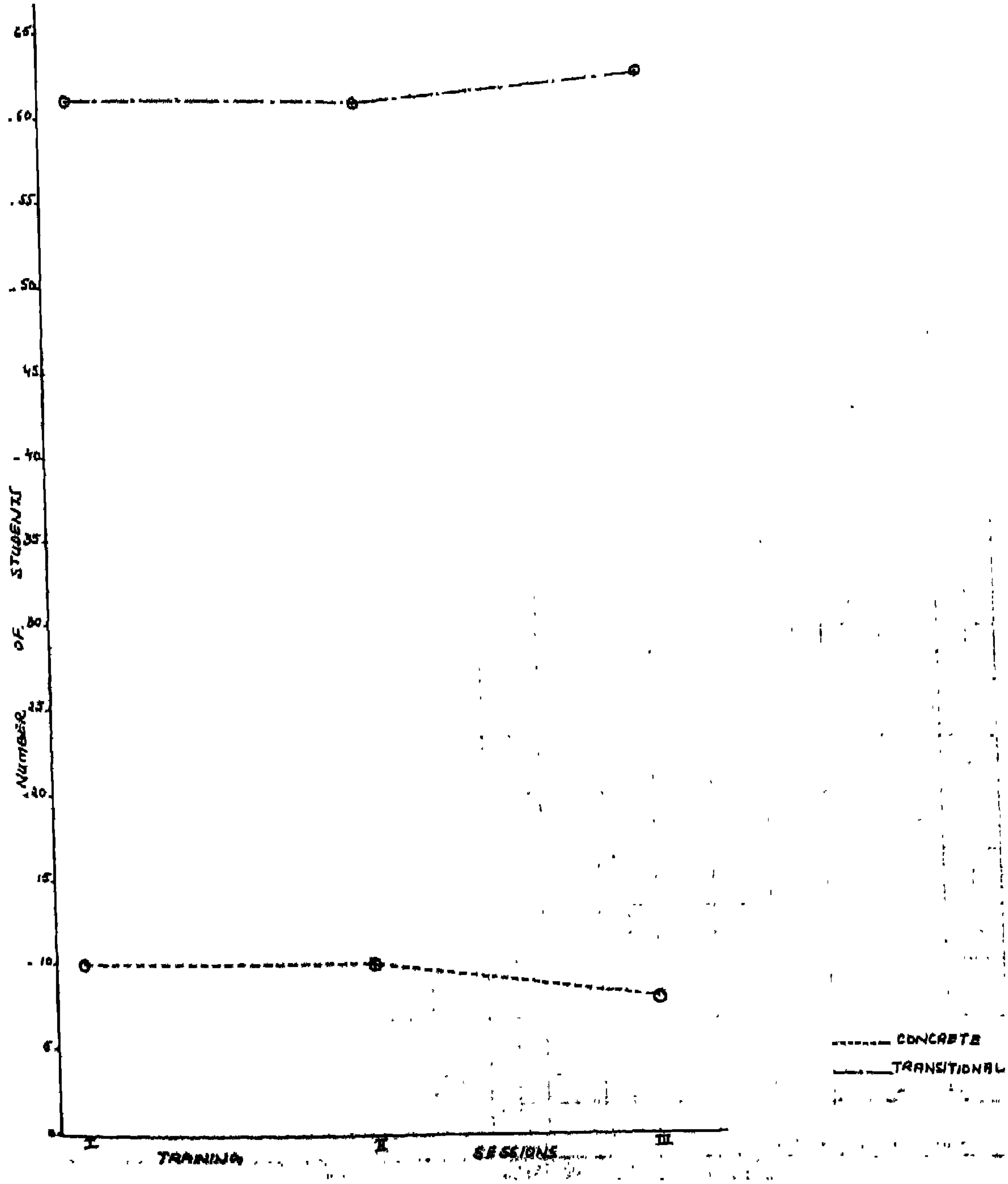
PERFORMANCE OF BOYS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM - 4



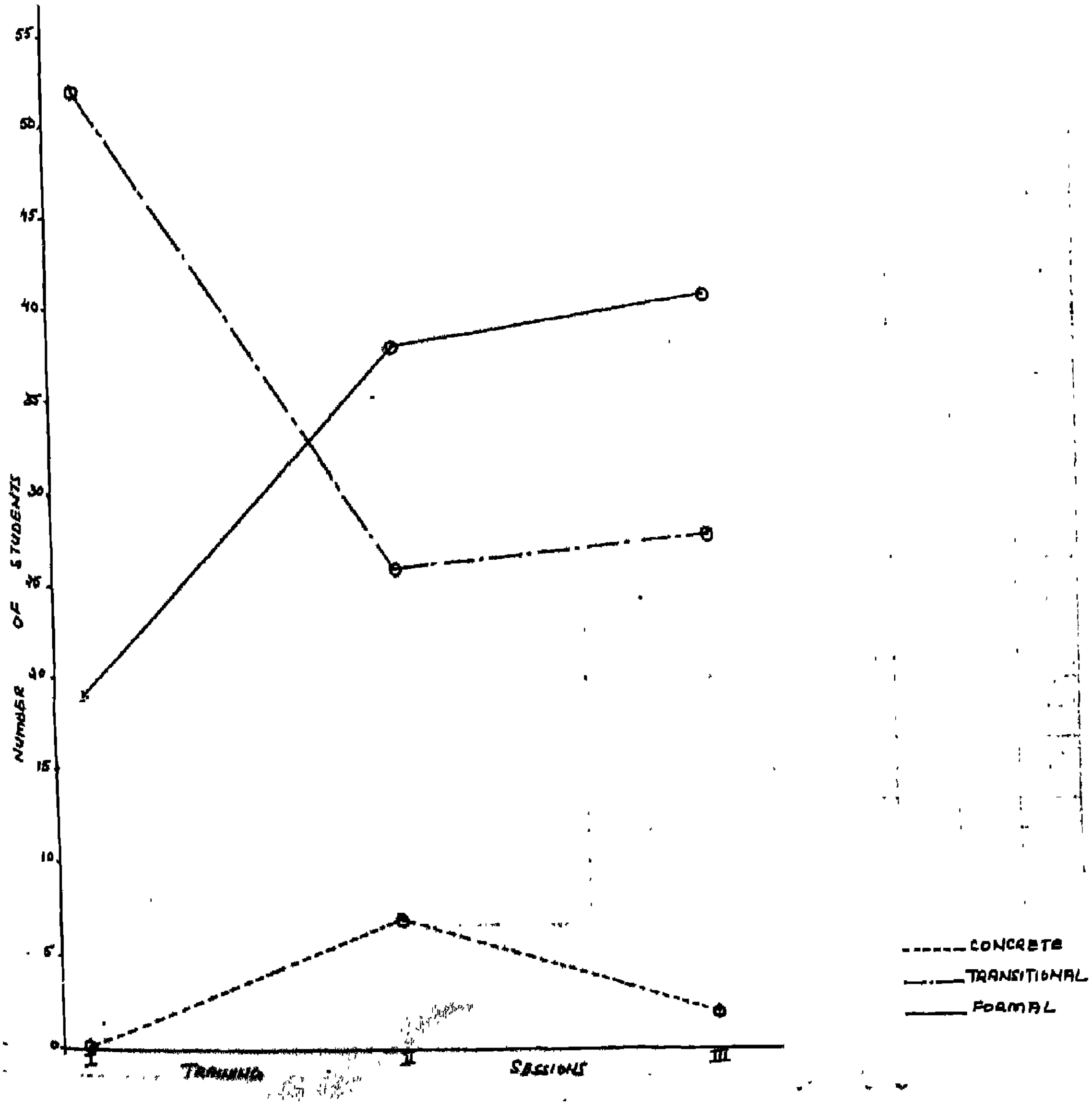
PERFORMANCE OF BOYS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM- 5.



PERFORMANCE OF BOYS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

TOTAL OF ALL THE PROBLEMS.



however, a progress in the third training session. The number of students at transitional level is 52 in the first training session, 26 in the second training session and 28 in the third training session. The number of students present at formal operational level is 19 in the first training session, 38 in the second training session and 41 in the third training session. Here there is seen a progress from the first training session to the third training session.

The performance of students for each task in each training session is graphically represented from Graph No.1 .to Graph No.6. Here we can conclude that the number of students decreases in the concrete stage gradually decreases. The students pass off to the transitional stage so leaving a fewer number in the concrete stage. Similarly, we see that the ratio for transitional and formal stage is inversely proportional, that is, as in the in formal stages as well, the number of student increases, the number in the transitional level decreases. More students from the transitional level pass into the formal stage. This is seen for all the problems from the first training session to the third training session.

The performance of girls at the three level of intellectual development during the three training session :

The number of girls at concrete stage of development in the first task is 16 in the first training session, 13 in

Table No.[illegible]

THE PERFORMANCE OF GIRLS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS

GRADE	Int. Dev.	I TRAINING						II TRAINING						III TRAINING					
		1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total
VII	C	1	4	5	9	15	2	5	2	5	7	13	3	1	1	13	15	15	2
18	T	17	14	12	9	3	16	13	16	13	11	5	15	17	17	3	3	3	16
	F			1												2			
VIII	C	13	12	13	18	19	13	5	2	5	10	10	4	9	-	1	-	5	-
20	T	7	8	6	1	1	7	15	18	14	9	10	16	10	20	8	19	15	20
	F				1					1	1			1		11	1		
IX	C	2	1	2	4	8	1	3	-	3	-	6	-	1	1	1	1	2	1
17	T	14	16	13	9	9	16	14	17	13	13	11	17	9	16	8	10	15	9
	F	1		2	4					1	4			7		8	6		7
X	C															1	1	1	-
20	T	20	20	14	13	20	20	9	20	11	13	20	12	4	20	3	7	19	8
	F			6	7			11		9	7		8	16		16	12		12

the second training session and 11 in the third training session. The number of girls at transitional level in the first training session is 58, in the second training session 51 and in the third training session 40. The number of students at formal operational level is 1 in the first training session, 11 in the second training session and 24 in the third training session. Here there is seen a progress of the students from concrete to the formal operational level as observed from the first training session to the third training session.

For the second task the number of girls at concrete level is 17 in the first training session, 4 in the second training session and 2 in the third trainning session. The number of students at transitional level is 58 in the first training session, 71 in the second training session and 73 in the third training session. The number of students at formal operational level is 0 in the first training session, 0 in the second training session and 0 in the third training session. The students did show a progress in the transitional level from the first to the third training session. However, not a single student reached the formal stage.

For the third task the number of students present at concrete level is 20 in the first training session, 13 in the second training session and 16 in the third training session. The number of students at the transitional level is 20 in the first training session, 13 in the second training session and

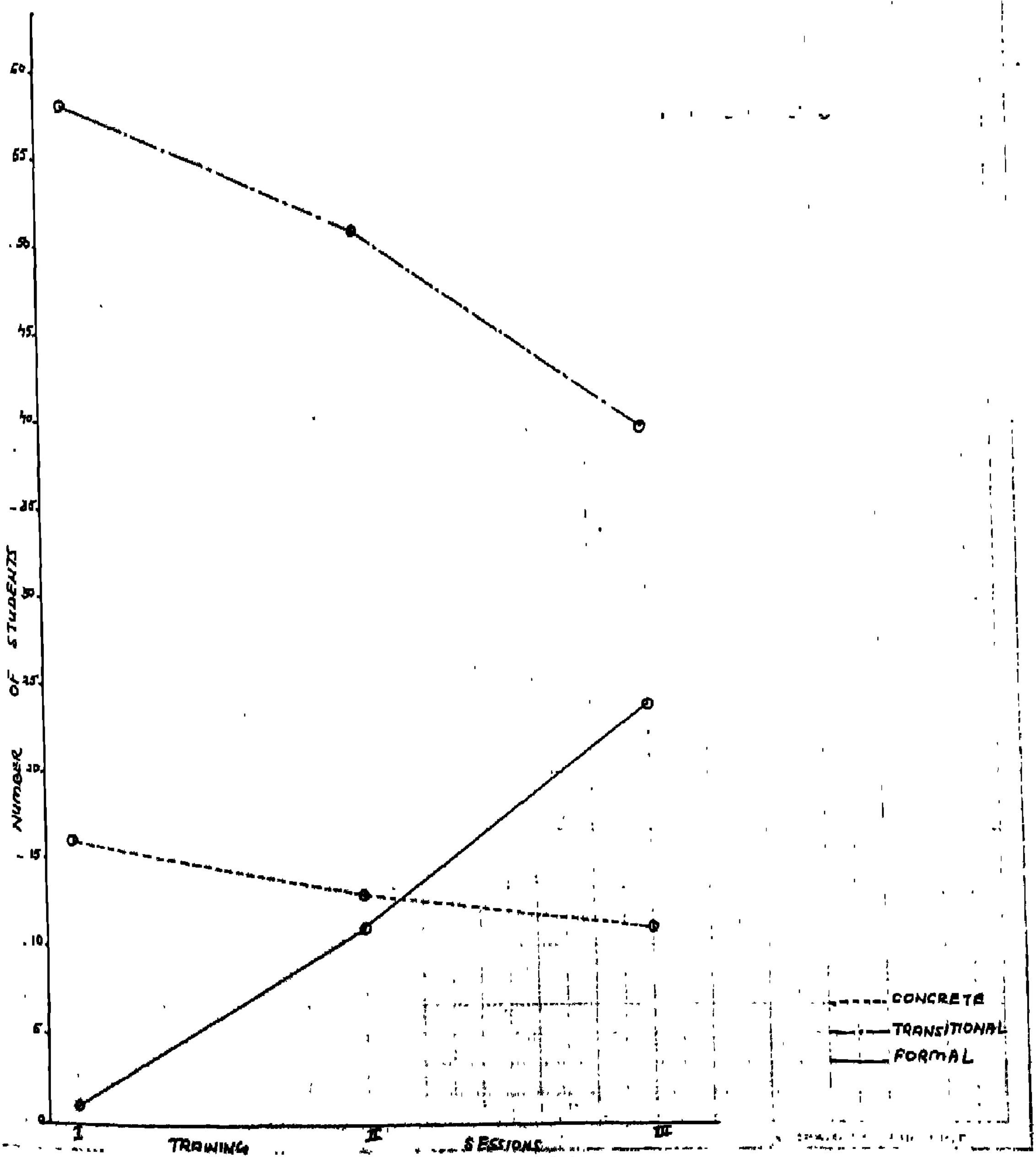
16 in the third training session. The number of students at the formal operational level is 10 in the first training session, 11 in the second training session and 37 in the third training session. Here a progress is seen in the formal operational level from first training session to the third training session. There is, however, seen a decline in the concrete level.

For task number four the number of students present in concrete level is 31 in the first training session, 17 in the second training session and 17 in the third training session. The number of students at the transitional level is 32 in the first training session, 46 in the second training session and 39 in the third training session. The number of girls at formal operational level is 12 in the first training session, 12 in the second training session and 19 in the third training session. Here a progress is seen from the first training session to the third training session.

The performance of girls for the fifth task is also analysed. The number of students at concrete level is 42 in the first training session, 29 in the second training session and 23 in the third training session. The number of students at transitional level is 33 in the first training session, 46 in the second training session and 64 in the third training session. The number of students at the formal operational level of intellectual level is 0 in all the three training

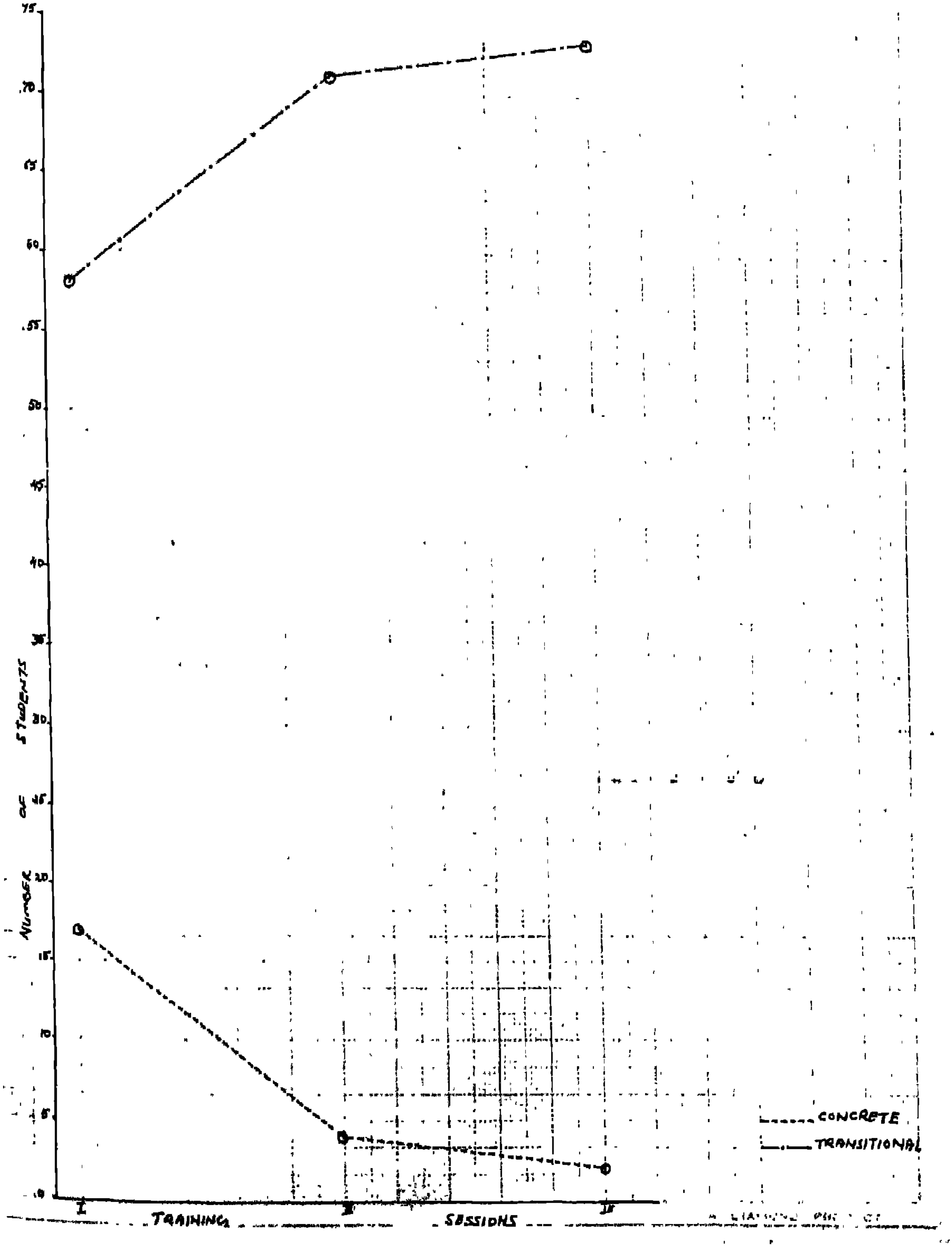
PERFORMANCE OF GIRLS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM - 1



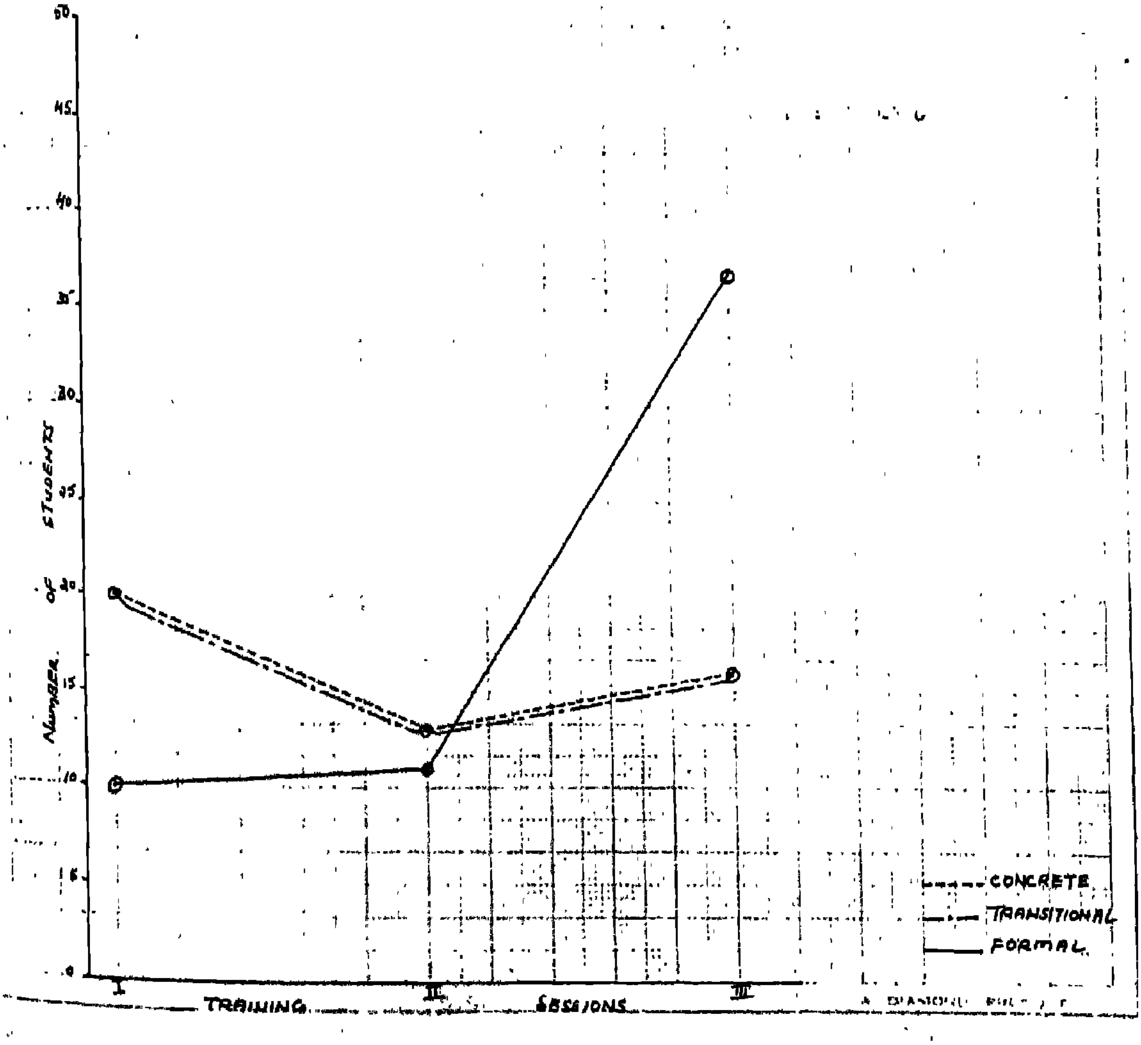
PERFORMANCE OF GIRLS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM – 2



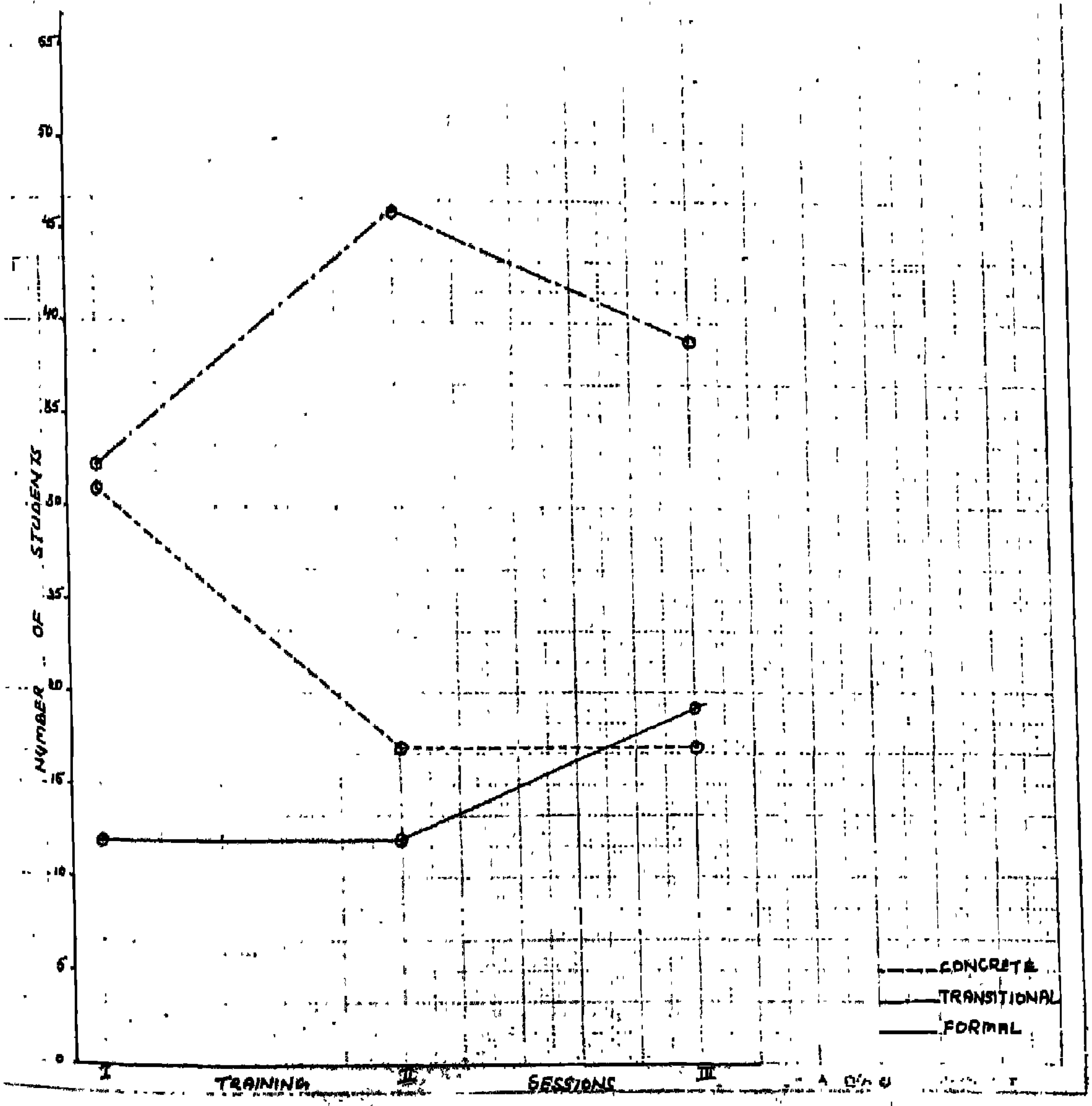
PERFORMANCE OF GIRLS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM -3



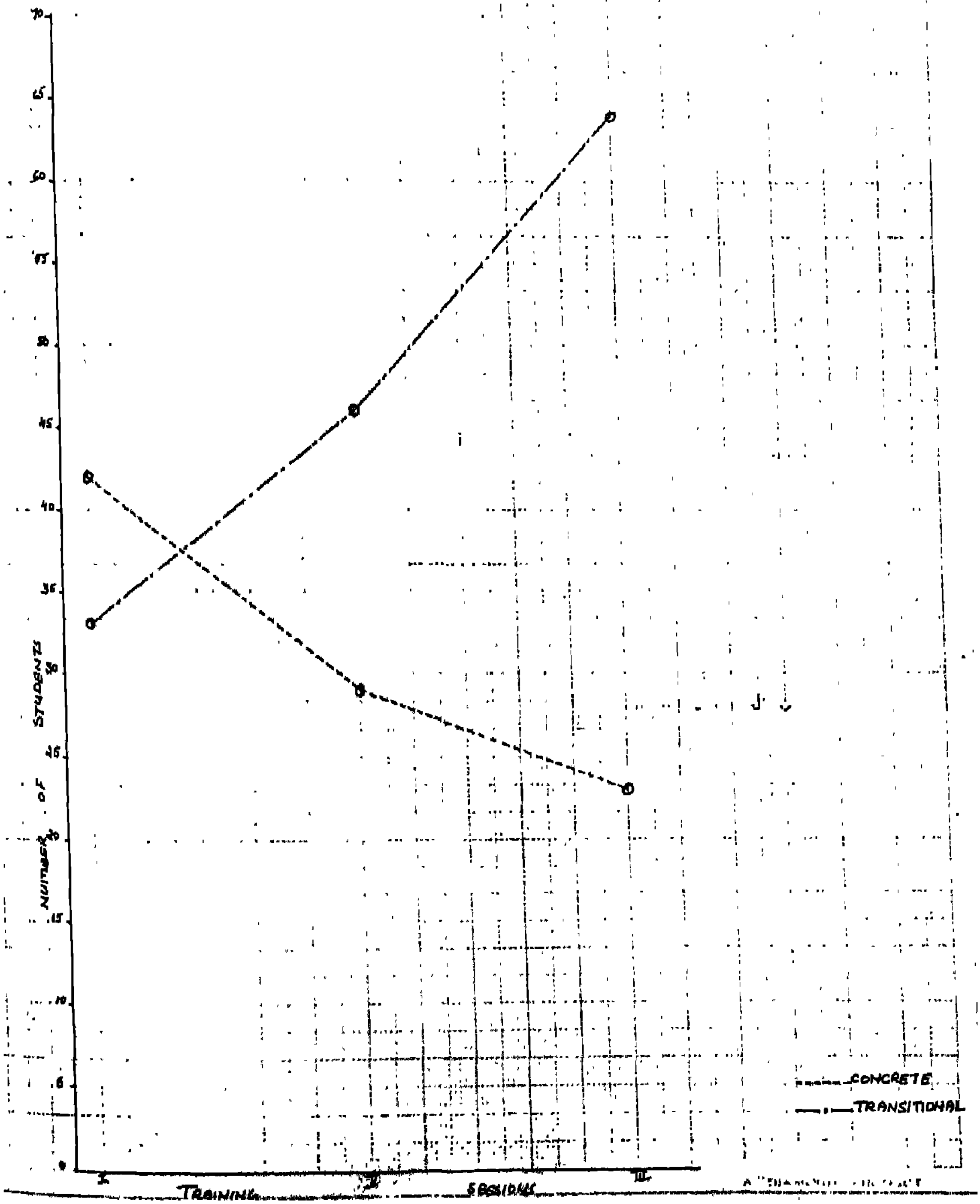
PERFORMANCE OF GIRLS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM- 4



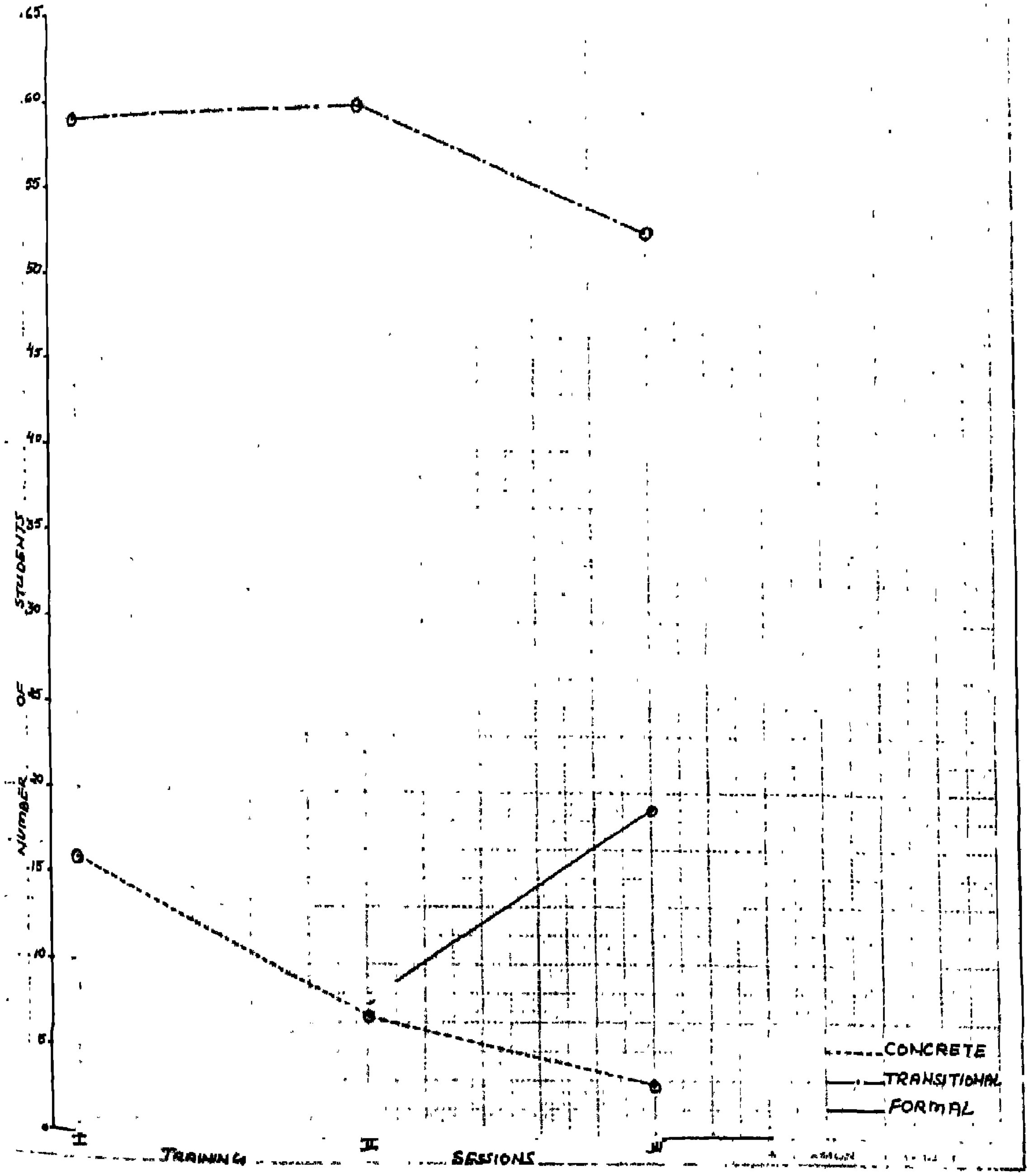
PERFORMANCE OF GIRLS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

PROBLEM -5



PERFORMANCE OF GIRLS AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE THREE TRAINING SESSIONS.

TOTAL OF ALL THE PROBLEMS.



sessions. There is seen a progress from the first training session to the third training session.

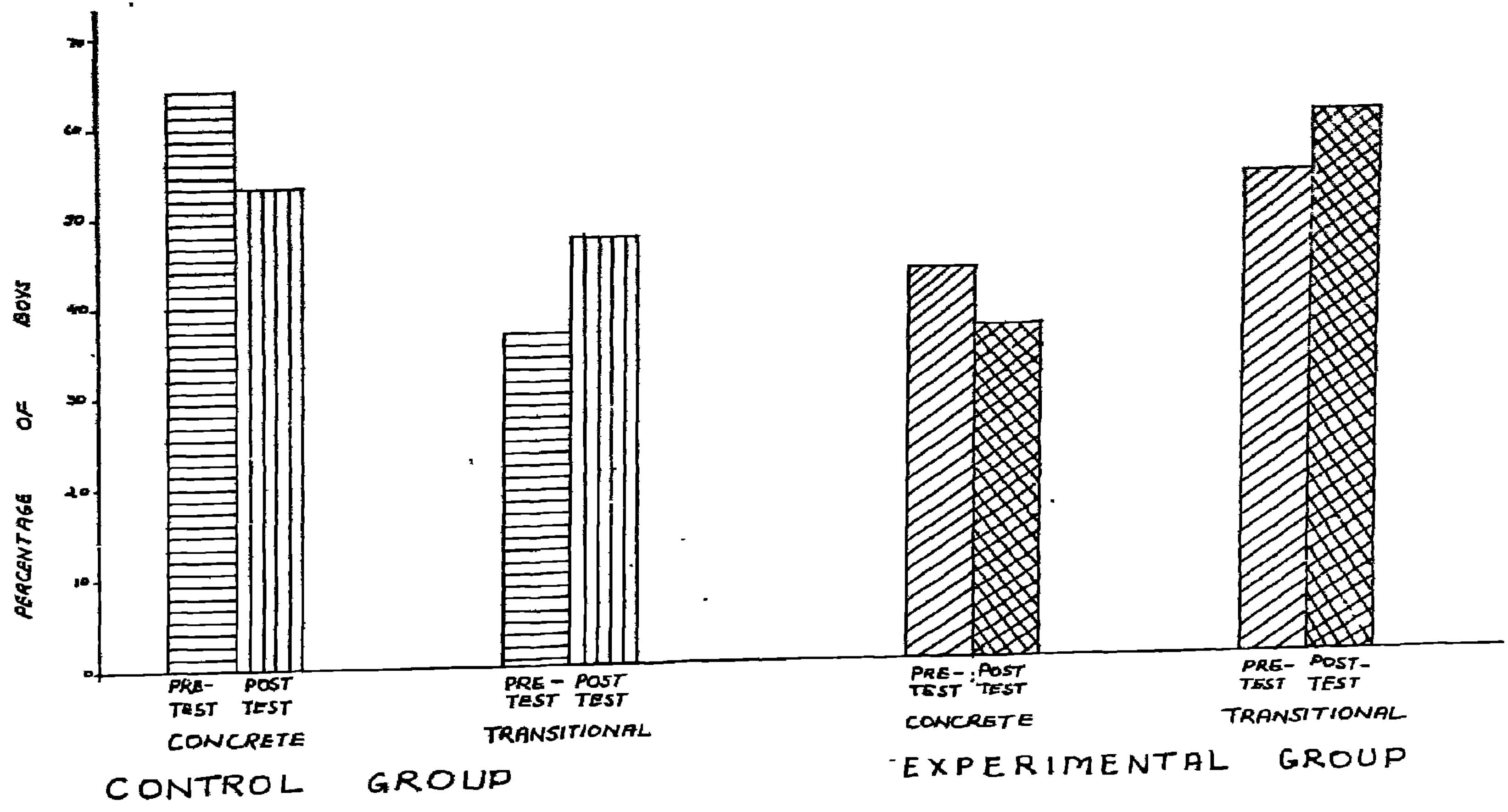
For the total of the tasks it is seen that the number of students present in the concrete level is 16 in the first training session, 7 in the second training session and 3 in the third training session. The number of students at transitional level is 59 in the first training session, 60 in the second training session and 53 in the third training session. The number of students at the formal operational level is 0 in the first training session, 8 in the second training session and 19 in the third training session. Here a progress is seen from first training session to the third training session.

The progrss of each task during each training session has been graphically represented from Graph No.7 to Graph No.12.

Percentage of boys of control and experimental group present at different levels of intellectual development during Pre-test and Post-test :

A bar graph was constructed to draw a comparative picture of the total sample of boys. These boys belonged to the experimental and control group. The purpose being to see at a glance at what levels were the boys initially present during the Pre-test and Post-test. From this graph, we find that at the concrete level 63.63 per cent of boys of control group and 43.66 per cent of boys of experimental group were observed.

PERCENTAGE OF BOYS OF CONTROL AND EXPERIMENTAL GROUP AT THE DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRE-TEST AND POST-TEST.



Similarly, 36.36 per cent boys of control group and 56.33 per cent boys of experimental group were present at the transitional level of intellectual development. However, not a single boy was found to be at the formal operational level of thought.

Comparing out of these two groups we find that a larger percentage of boys were found at the concrete stage in control group. Larger number of boys were found to be at the transitional level of experimental group.

Percentage of boys of control and experimental group present at the three level of intellectual development during Post-test :

Graph No.14 enables to draw a comparative picture of boys of control and experimental group at the time of Post-test. No training was imparted to the control group. The experimental group was treated with three training sessions. Both the control and the experimental groups were simalteneously exposed to similar Post-test.

It was found out that 53.24 percentage of boys were at concrete level for the control group, whereas 30.98 percentage of boys of experimental group were found to be at the concrete level. Similarly, 46.75 percentage of boys of control group and 69.01 percentage of boys of experimental group were found to be at the transitional level of intellectual development.

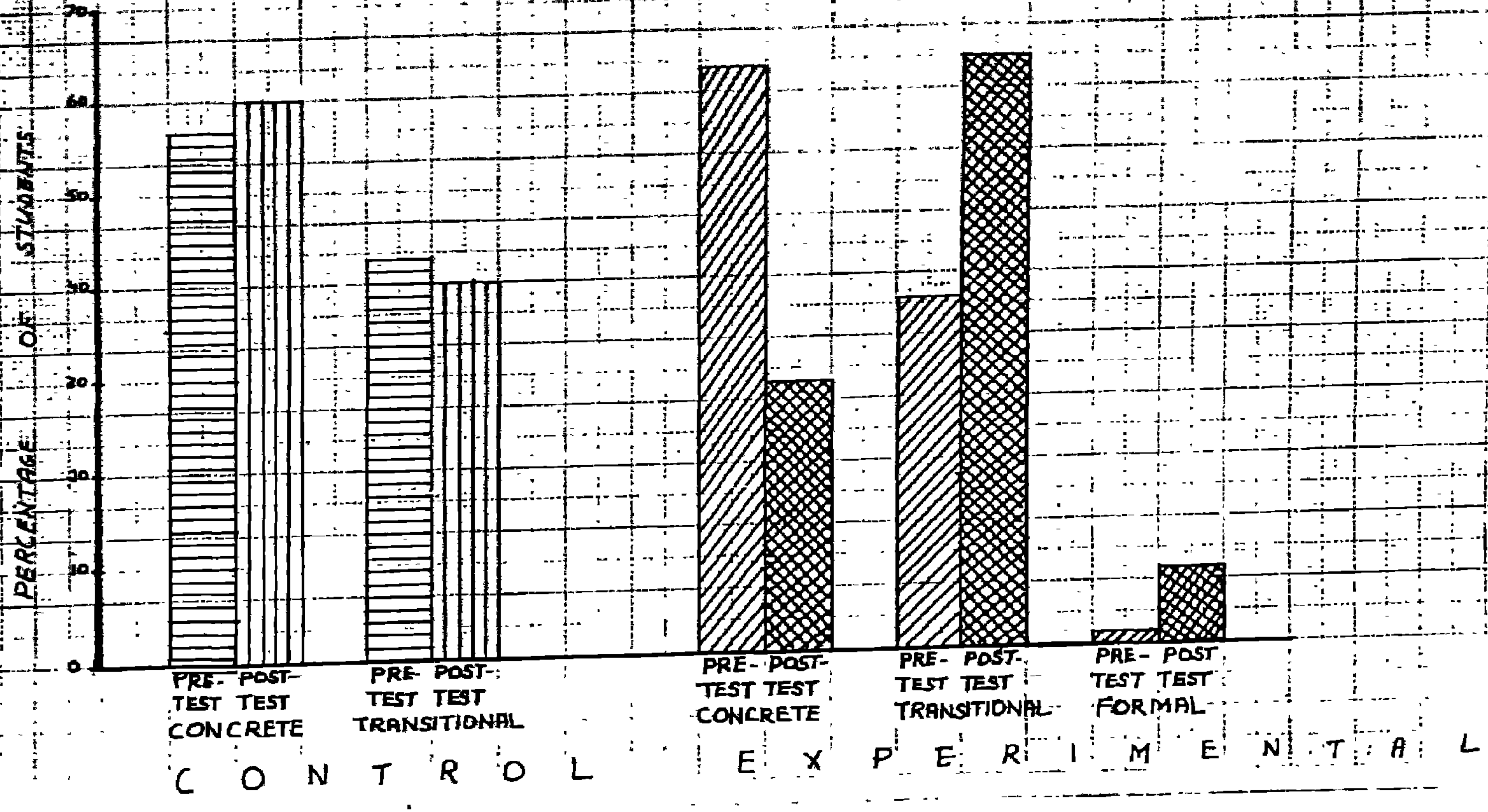
Hence a larger percentage of boys at concrete level is found in case of control group, and a larger per cent of boys is found at transitional level for the experimental group. No student was, however, found to be present at formal stage either in the control group or the experimental group. This also shows that the performance of boys of experimental group is better than the performance of boys of control group as a higher percentage of boys is found at a higher level of intellectual development in case of experimental group.

Percentage of girls of control and experimental group present at different levels of intellectual development during Pre-test and Post-test :

The performance of the total sample of girls during Pre-test for both the control and the experimental groups at different levels of intellectual development is seen in Graph No.14. The experimental group and the control group was given the same tasks.

The percentage of girls at concrete level of intellectual development for control group is 57.33 and experimental group is 61.33. The percentage of girls at transitional level for control group is 42.66 and for experimental group is 37.33. No student was found to be at formal operational stage for control group. 1.33 per cent girls of experimental group were found to be at the formal operational thought.

PERCENTAGE OF GIRLS OF CONTROL AND EXPERIMENTAL GROUP AT DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT DURING PRE TEST AND POST TEST



When comparing these two groups we find that a larger number of students were found at concrete level in case of control group. Larger number of girls at transitional level was observed in case of experimental group. Some students also reached the formal operational stage in case of experimental group. Hence, the performance of girls of experimental group was better than the performance of girls of control group.

Percentage of girls of control and experimental group present at the three level of intellectual development during Post-test :

The performance of the total sample of girls of both the control and the experimental group at different levels of intellectual development during Post-test is seen in Graph No. 14 Three training sessions was imparted only to the experimental group. No training was imparted to the control group. The tasks for both the groups was similar.

The percentage of girls at concrete level of control group is 60.00 and of experimental group is 29.33. The percentage of girls at transitional level for control group is 40.00 and for experimental group 62.66. The percentage of girls at formal stage for experimental group is 8.00. No student, however, reached the formal operational stage in the control group.

A considerable difference was noted between the two groups. The performance of girls of experimental group is better than the performance of girls of control group. A larger per cent of girls reached the transitional and formal operational level in the experimental group.

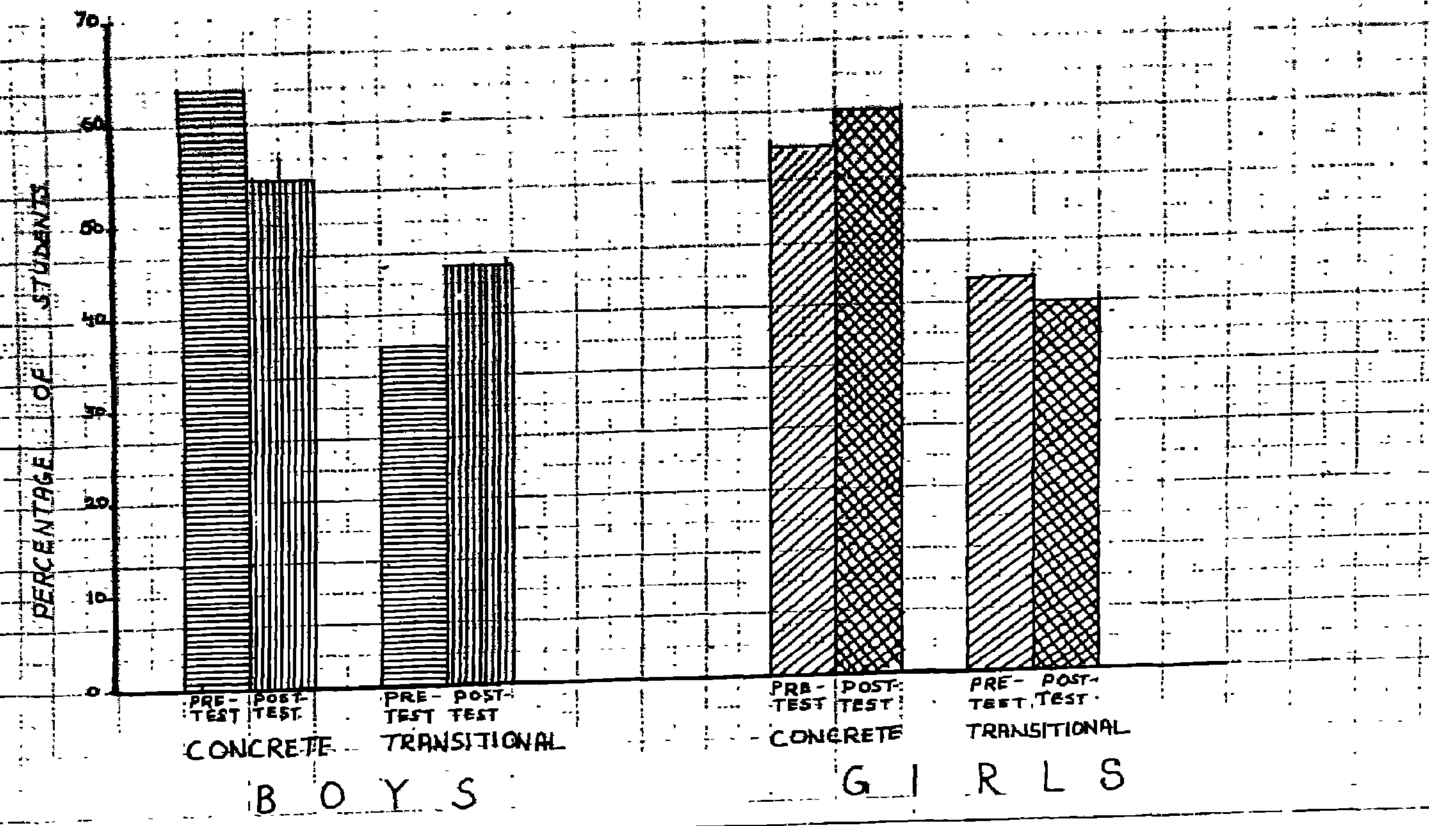
Percentage of boys and girls of conttol group present at the different levels of intellectual development during Pre-test and Post-test :

Graph No.21 shows the initial stage of intellectual development at which the boys and girls of control group.

The percentage of boys at concrete level is 63.63 and of girls is 57.33. The percentage ofboys at transitional level is 36.36 and of girls is 42.66. Not a single student either the boys or girls was found at the formal operational level.

From the above mentioned percentage, we find that a larger number of girls were present at the transitional level during the Pre-test. This shows that the performance of girls of control group is better than the perfomance of boys for the same test.

PERCENTAGE OF BOYS AND GIRLS OF CONTROL GROUP AT THE DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRE TEST AND POST TEST



Percentage of boys and girls of control group present at different levels of intellectual development during Post-test :

Graph No.22 shows the level of intellectual development attained by the total sample of boys and girls of only control group during Post-test. No training was imparted to both these control group. The task used was similar to both the groups.

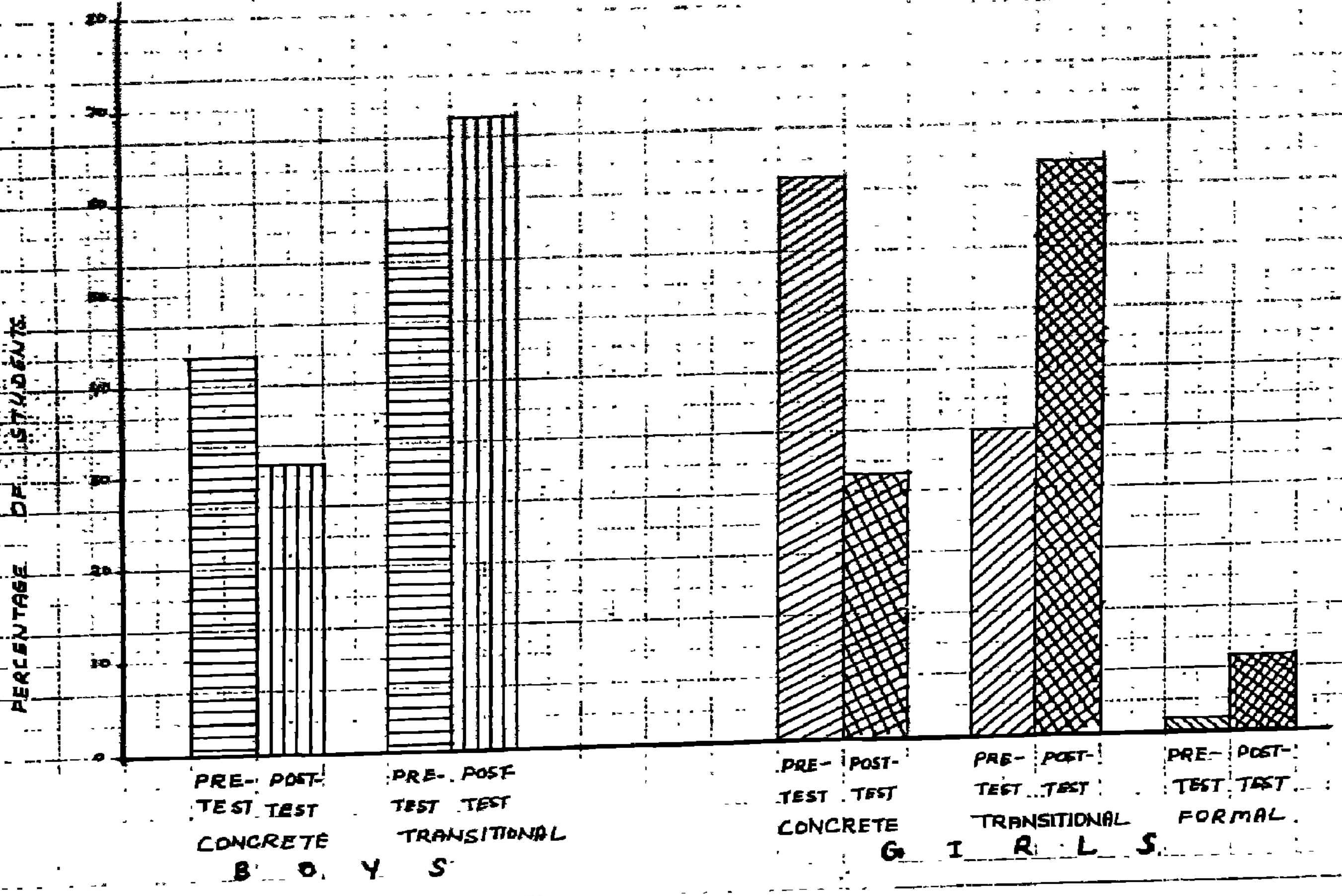
The percentage of boys at concrete level is 53.24 and of girls is 60.00. The percentage of boys at transitional level is 46.75 and of girls is 40.00. Not a single student of either boys or girls was present at the formal operational level of thought.

A larger percentage of boys was present at higher level of intellectual development. A larger percentage of girls were present at the lower level of intellectual development. This shows that the performance of boys of control group during Post-test was better than the girls of the control group for the same test.

Percentage of boys and girls of experimental group at the different levels of intellectual development during Pre-test and Post-test :

A pre-test consisting of five Piagetian task based on two schemes of thought was given to be solved by the total

PERCENTAGE OF BOYS AND GIRLS' OF EXPERIMENTAL GROUP PRESENT AT THE DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRETEST AND POSTTEST.



samples comprising of both boys and girls of control and experimental groups. The level of intellectual development at which the boys and girls of experimental group initially present is seen in Graph No.23.

The percentage of boys present at concrete level is 43.66 and of girls is 61.33. The percentage of boys present at transitional level is 56.33 and of girls is 37.33. Not a single boys was found to be present at the formal operational level. However, in case of girls 1.33 per cent were found to be at the formal operational level.

Seeing the above data, we find that the performance of boys is slightly better than the girls when seeing the overall picture. However, only the girls group reached the higher level of intellectual development viz., the formal operational level of thought, which was totally lacking in case of boys.

Percentage of boys and girls of experimental group present at the different levels of intellectual development during the Post-test :

A battery of five Piagetian type task was used to find out the intellectual level at which the total sample of boys and girls were present at Pre-test. After the Pre-test, three training sessions were imparted to the experimental group. Immediately after the third training session, Post-test, which was identical to the Pre-test, was administered. The level of

intellectual development attained by the total sample of experimental group during Post-test is shown in Graph No.16

The percentage of boys present at concrete level is 30.98 and of girls is 29.33. The percentage of boys present at ttransitional level is 69.01 and of girls is 62.66. Not a single boy reached the formal level of intellectual development. Whereas 8 per cent of girls were found to be present at formal operational level.

The above data indicate that the group of girls was able to reach at a higher level of intellectual development which the boys were not able to attain.

Grade-wise / age-wide performance of the experimental groups for each task :

The main aim of the study was to find out the effect of training on various scheme of thoughts. For this purpose, training was given only to the experimental group.

The performance of boys and girls after having received the training is given in Graph No.18 and 19. The graph shows the initial level of intellectual development at which the student was, that is, at the Pre-test, and at the Post-test. An effort is also made to show the changes of the intellectual development. Earlier in the chapter, it has been explained how if the number of student at the concrete level decreases,

Table No.21

Grade - wise / age - wise performance in
percentage of experimental groups for each task

Grade/ age	Test	Level of ID	Task 1	Task 2	Task 3	Task 4	Task 5	Total
1	2	3	4	5	6	7	8	9
BOYS								
VII	Pre- test	C	60	50	60	55	40	45
11+		T	40	50	40	45	60	55
	Post- test	C	45	55	75	60	60	50
		T	55	45	25	40	40	50
VIII	Pre- test	C	47.05	47.05	41.17	41.17	52.94	47.05
12+		T	52.95	52.95	58.83	58.83	47.06	52.95
	Post- test	C	23.52	23.52	23.52	23.52	17.64	23.52
		T	76.48	76.48	76.48	76.48	82.35	76.48
IX	Pre- test	C	35.29	29.41	23.52	29.41	35.29	35.29
13+		T	64.71	70.59	76.48	70.59	64.71	64.71
	Post- test	C	5.88	-	-	-	-	-
		T	94.12	100	100	100	64.70	100
		F					35.30	
X	Pre- test	C....	35.29	52.94	47.06	58.82	47.05	47.05
14+		T	64.71	47.06	52.94	41.18	52.95	52.95
	Post test	C	52.94	52.94	70.58	58.82	52.95	47.05
		T	47.06	47.06	29.41	41.18	29.41	52.95
		F					17.64	

1	2	3	4	5	6	7	8	9
GIRLS								
VII	Pre-test	C	94.44	100	100	100	100	100
11+		T	5.56	-	-	-	-	-
	Post test	C	38.88	72.22	77.77	77.77	88.88	50
		T	61.12	27.78	23.23	22.23	-	50
		F					11.12	
VIII								
12+	Pre test	C	45	40	50	60	55	50
		T	55	60	50	40	45	50
	Post test	C	100	100	100	100	35	35
		T	-	-	-	-	-	65
		F					65	
IX	Pre-test	C	23.52	23.52	17.64	23.52	23.52	70.59
13+		T	76.48	76.48	82.36	76.48	76.48	23.52
		F						5.89
	Post test	C	11.76	17.64	23.52	29.41	35.29	11.76
		T	88.24	82.36	76.48	70.59	41.17	58.82
		F					23.54	29.42
X	Pre-test	C	40	20	30	35	30	30
14+		T	60	80	70	65	70	70
	Post test	C	40	40	40	40	10	20
		T	60	55	55	60	25	75
		F		5	5		65	5

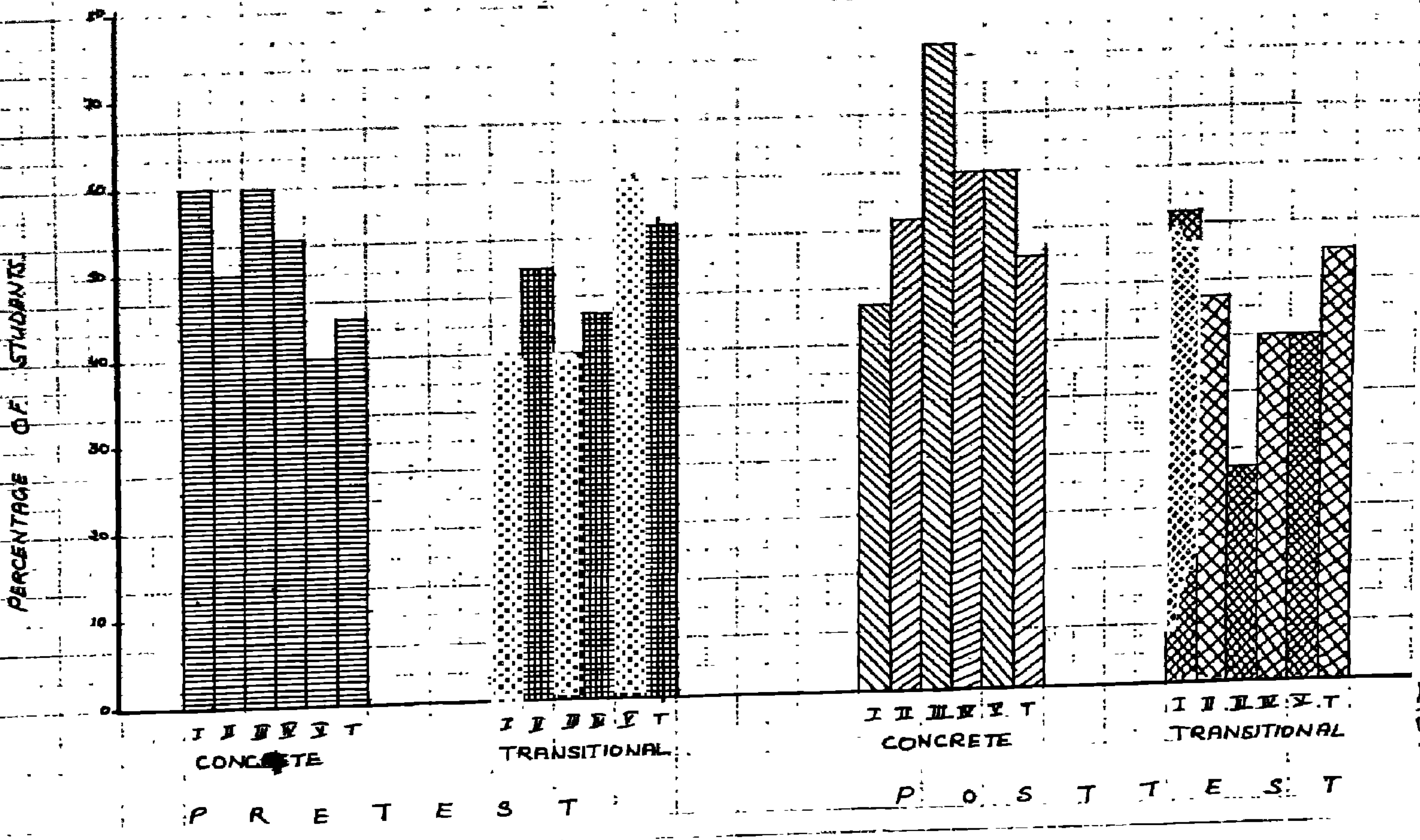
the number of students during that particular task in the transitional level increases and vice-versa.

For task No.1 in grade VII, age 11+ we see an improvement for boys group. At the Pre-test, the number of students at concrete level is 60 per cent and transitional level is 40 per cent. In the Post-test, the students at concrete level is 45 per cent. Much less than the concrete level at the Pre-test. But there is increase in the transitional level which is 55 per cent. Thus, we see that in Pre-test the decrease of 15 per cent in concrete level at the Pre-test is compensated by the 15 per cent increase at the transitional level for the Post-test.

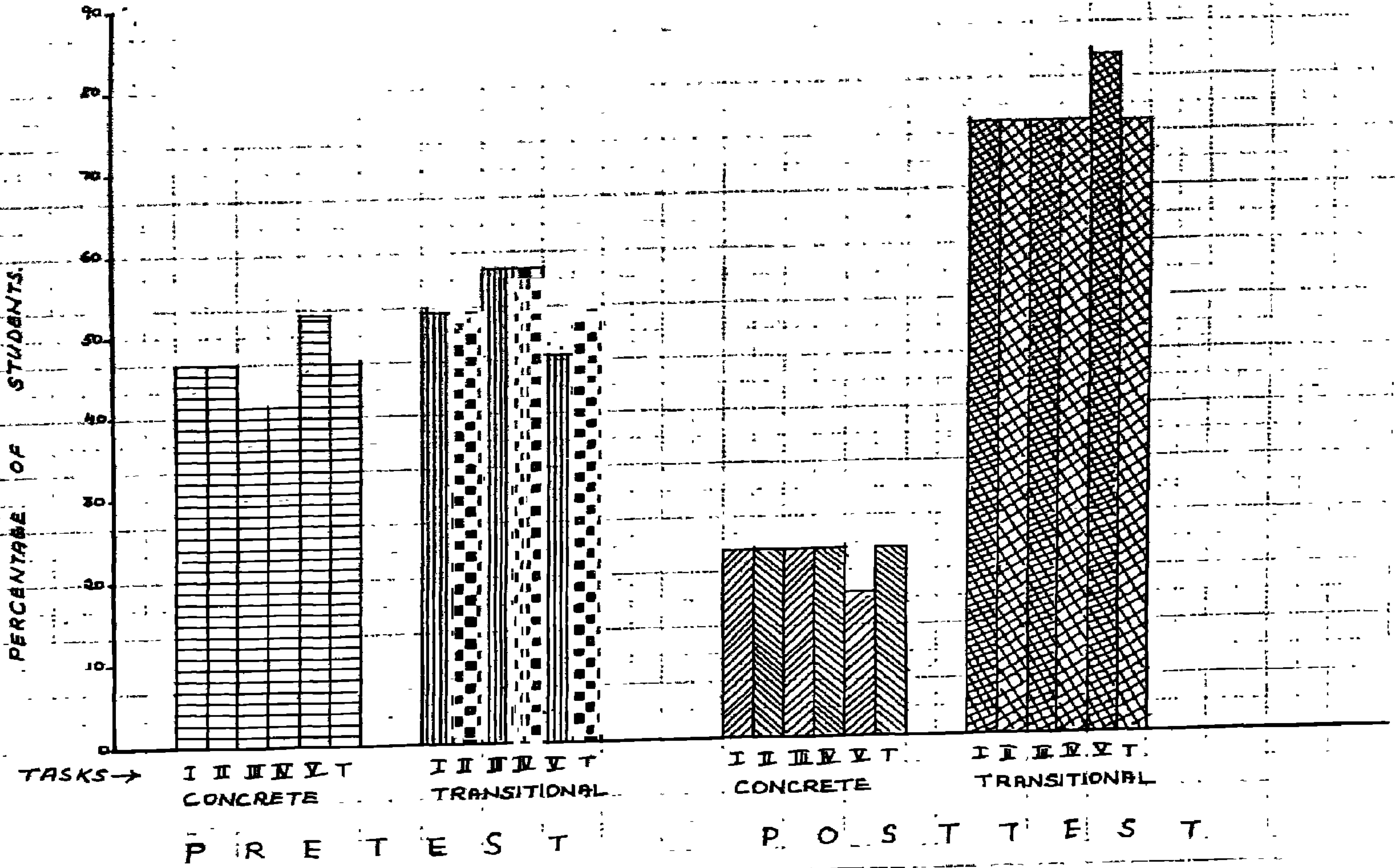
For all the other tasks in case of boys of this grade there is seen no improvement, that is, in the concrete level at Post-test the number of students is more than the Pre-test. For this grade there is seen very little influence of training. The results of girls show an improvement for all the tasks. The percentage of students for various tasks at different level of intellectual development is given in Table No.21.

For grade VIII, age 12+ boys there is seen an improvement from the Pre-test to the Post-test. More students pass from concrete level to the transitional level. The ratio remains the same i.e., one less in concrete level (Pre-test) is balanced by one increase in the transitional level for Post-test. In case of girls, there is an improvement only in task

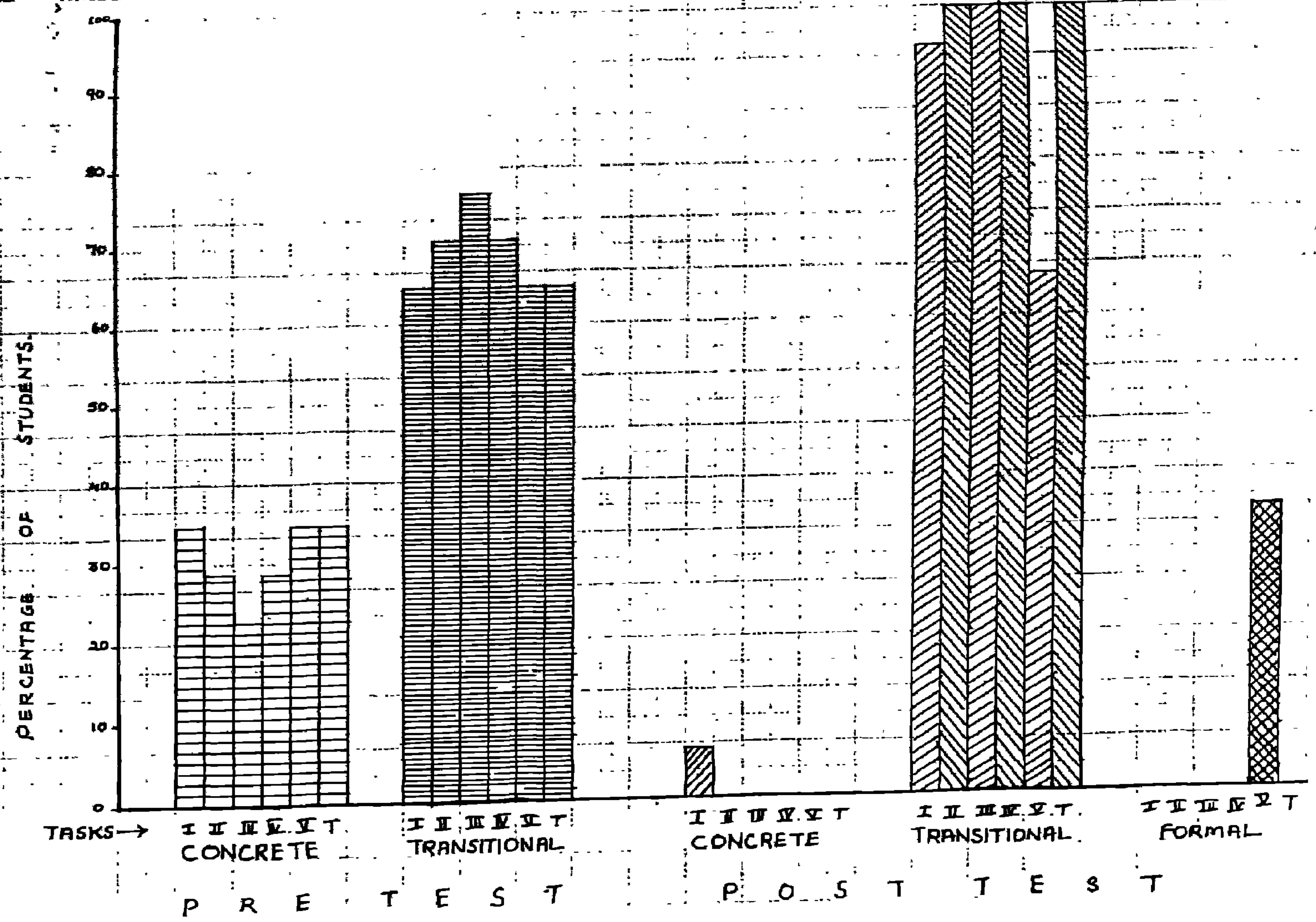
THE PERFORMANCE OF BOYS OF EXPERIMENTAL GROUP - GRADE VII - AGE 11+ FOR EACH TASK AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRETEST AND POSTTEST.



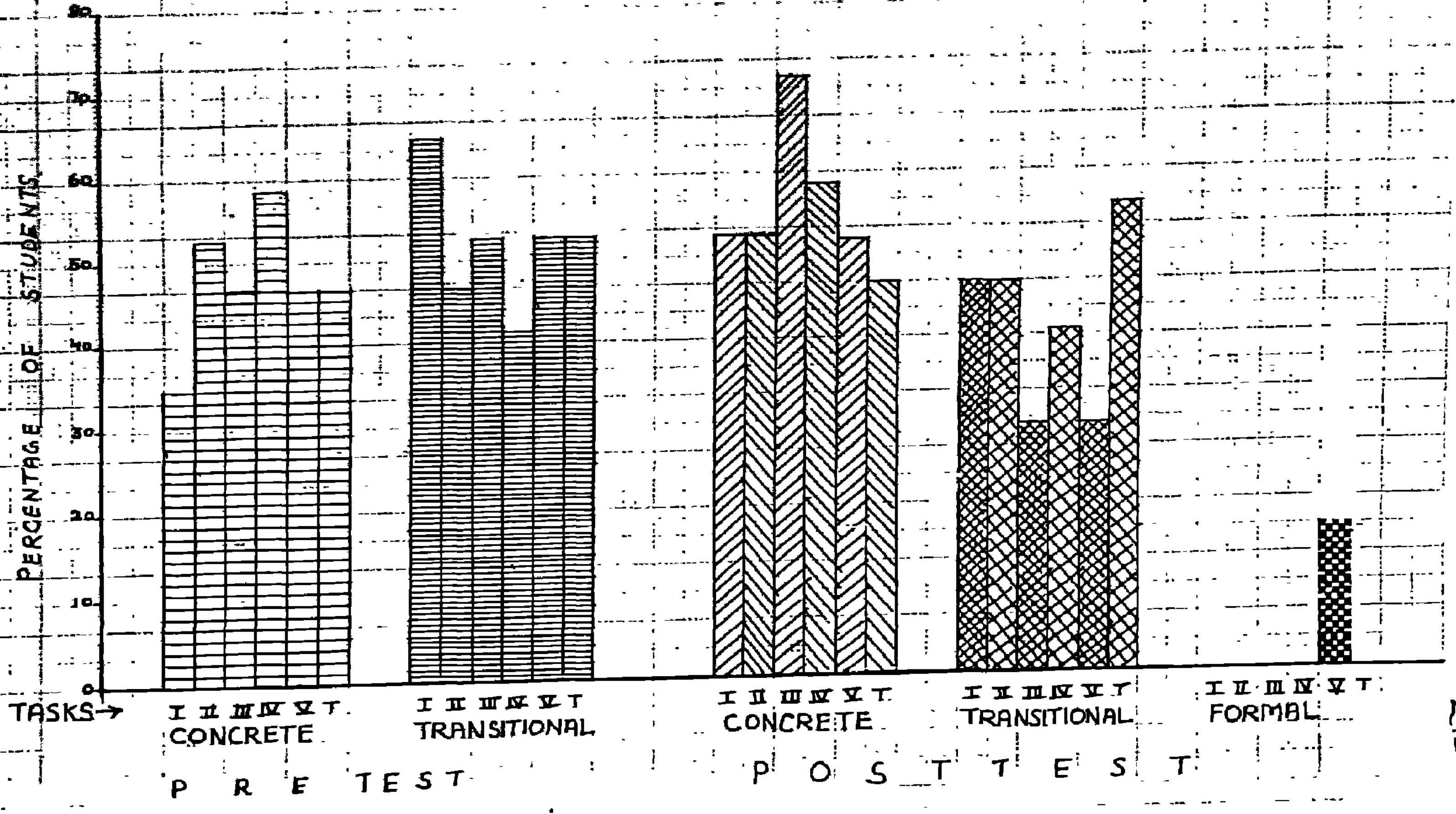
THE PERFORMANCE OF BOYS OF EXPERIMENTAL GROUP - GRADE VIII, AGE 12+ FOR EACH TASK AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRETEST AND POST-TEST.



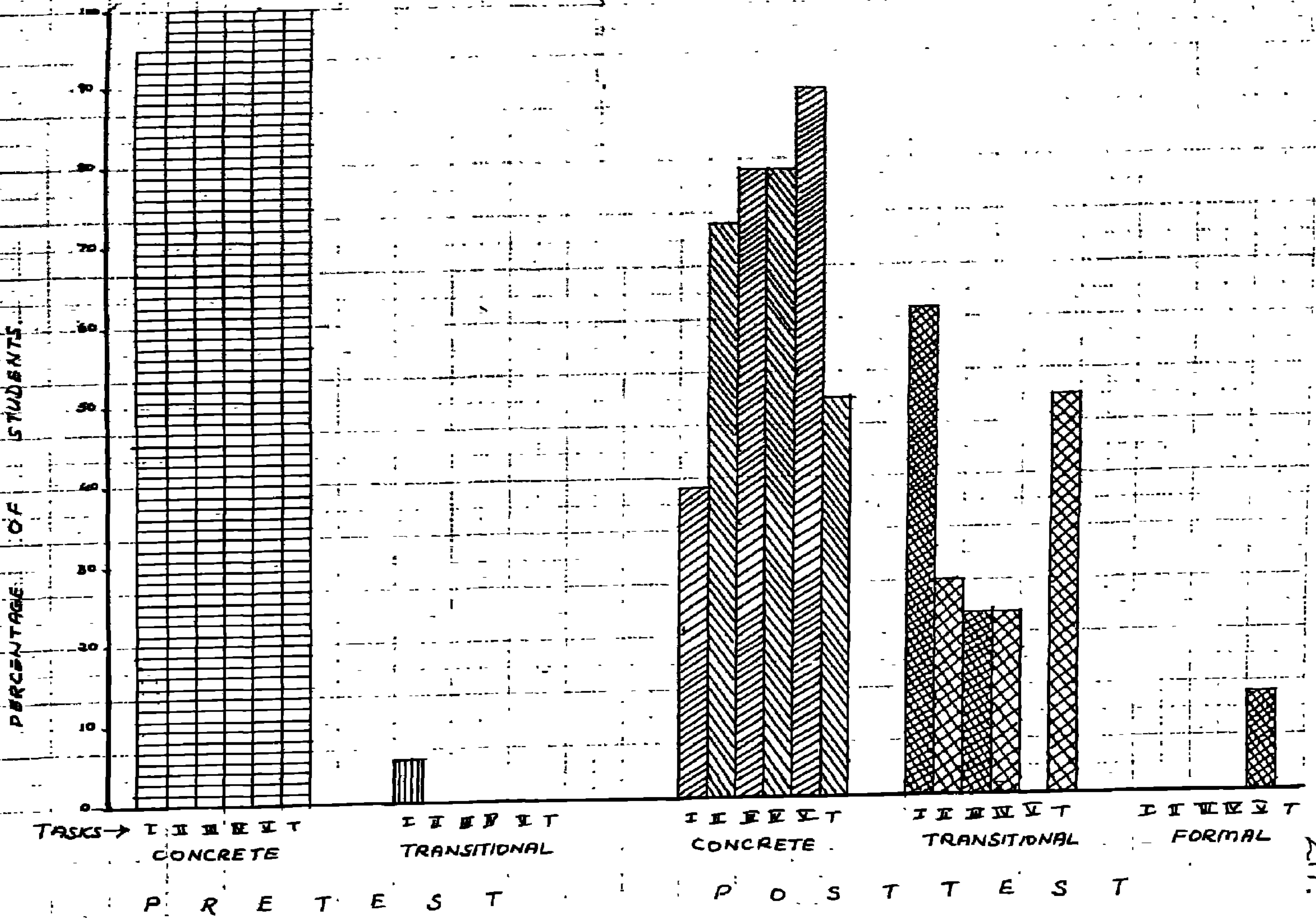
THE PERFORMANCE OF BOYS OF EXPERIMENTAL GROUP - GRADE IX - AGE 13+ FOR EACH TASK AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRE-TEST AND POST-TEST



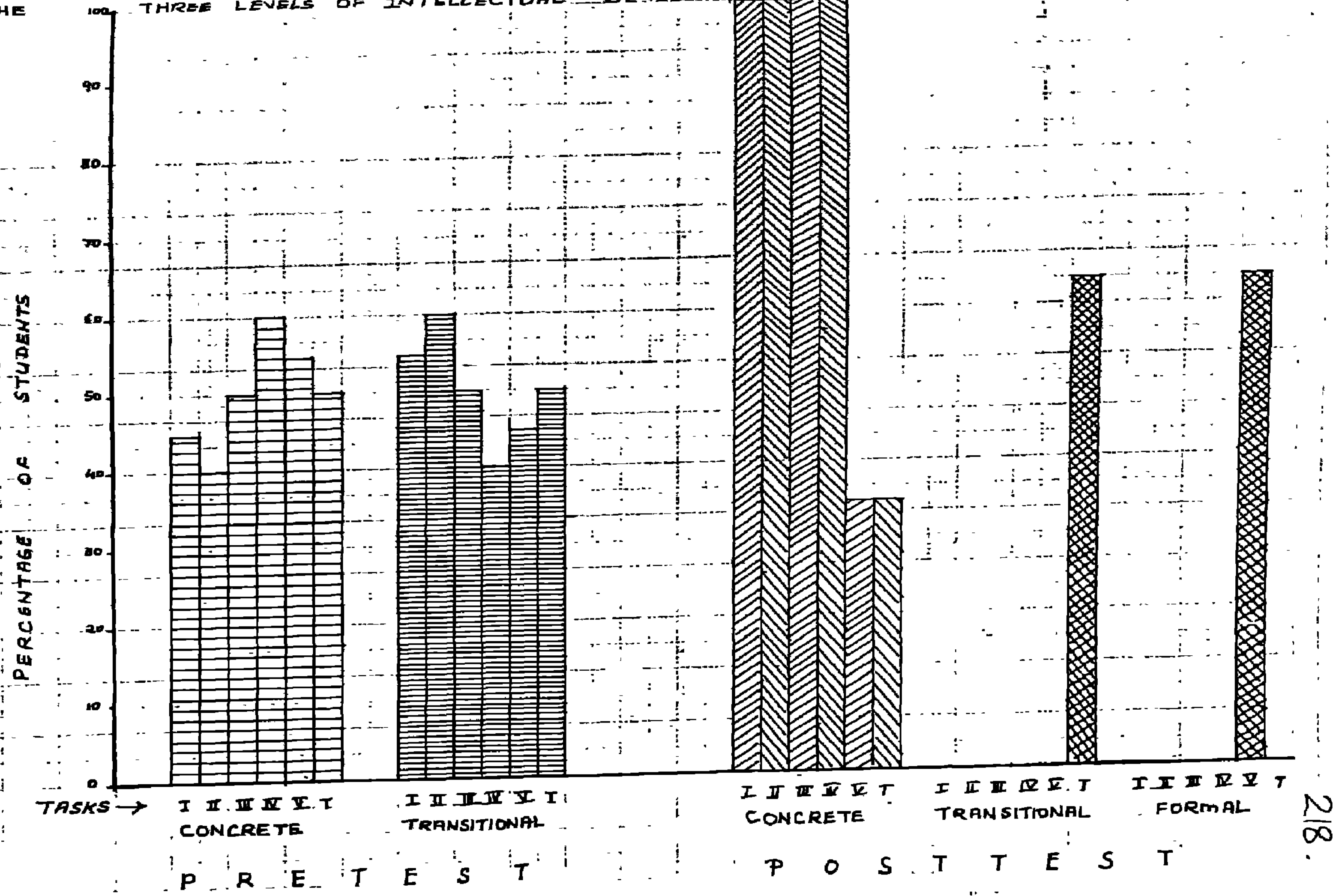
AT THE THREE LEVELS OF INTELLECTUAL



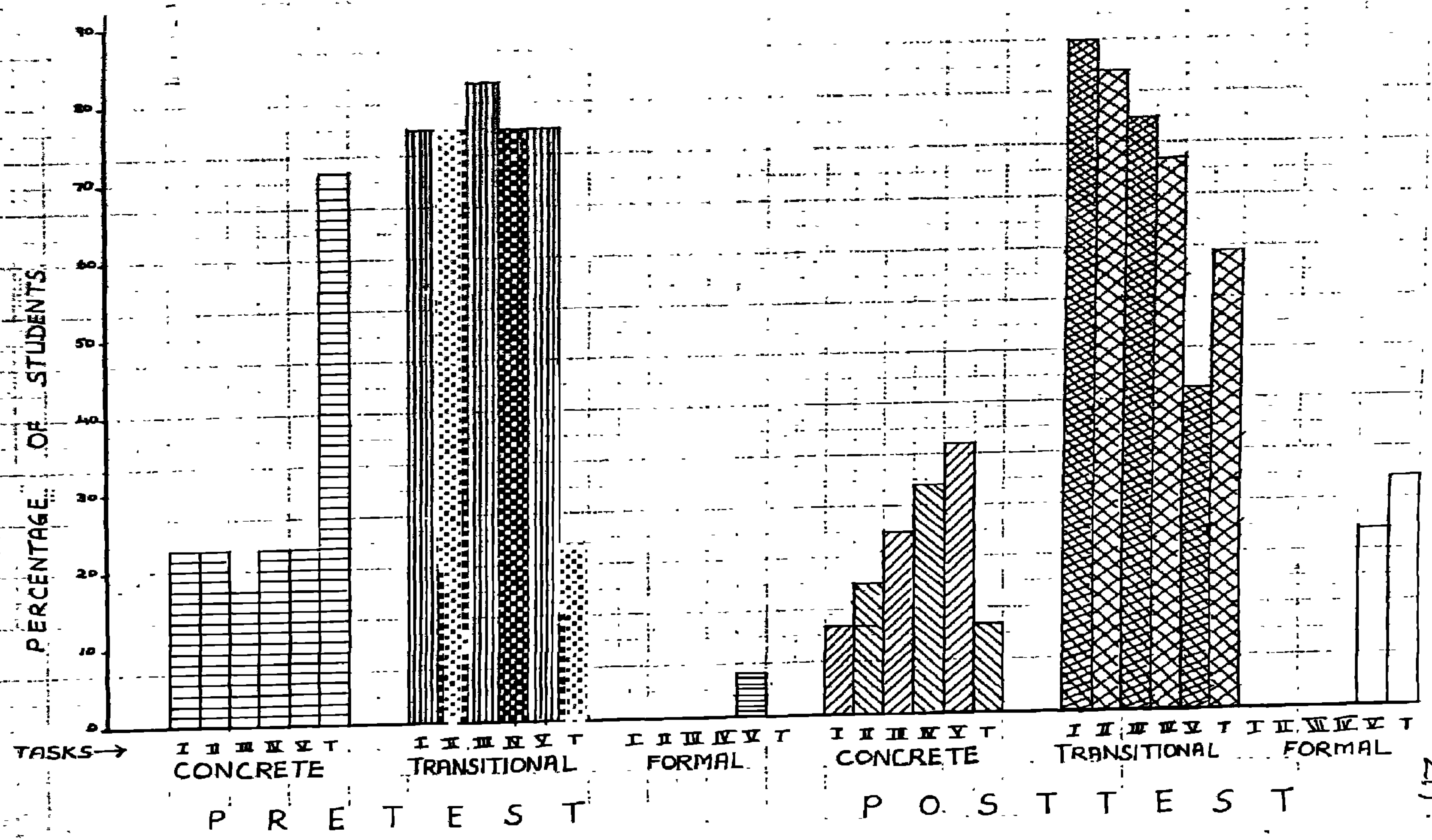
THE PERFORMANCE OF GIRLS OF EXPERIMENTAL GROUP - GRADE VII - AGE 11+ FOR EACH TASK AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRETEST AND POSTTEST



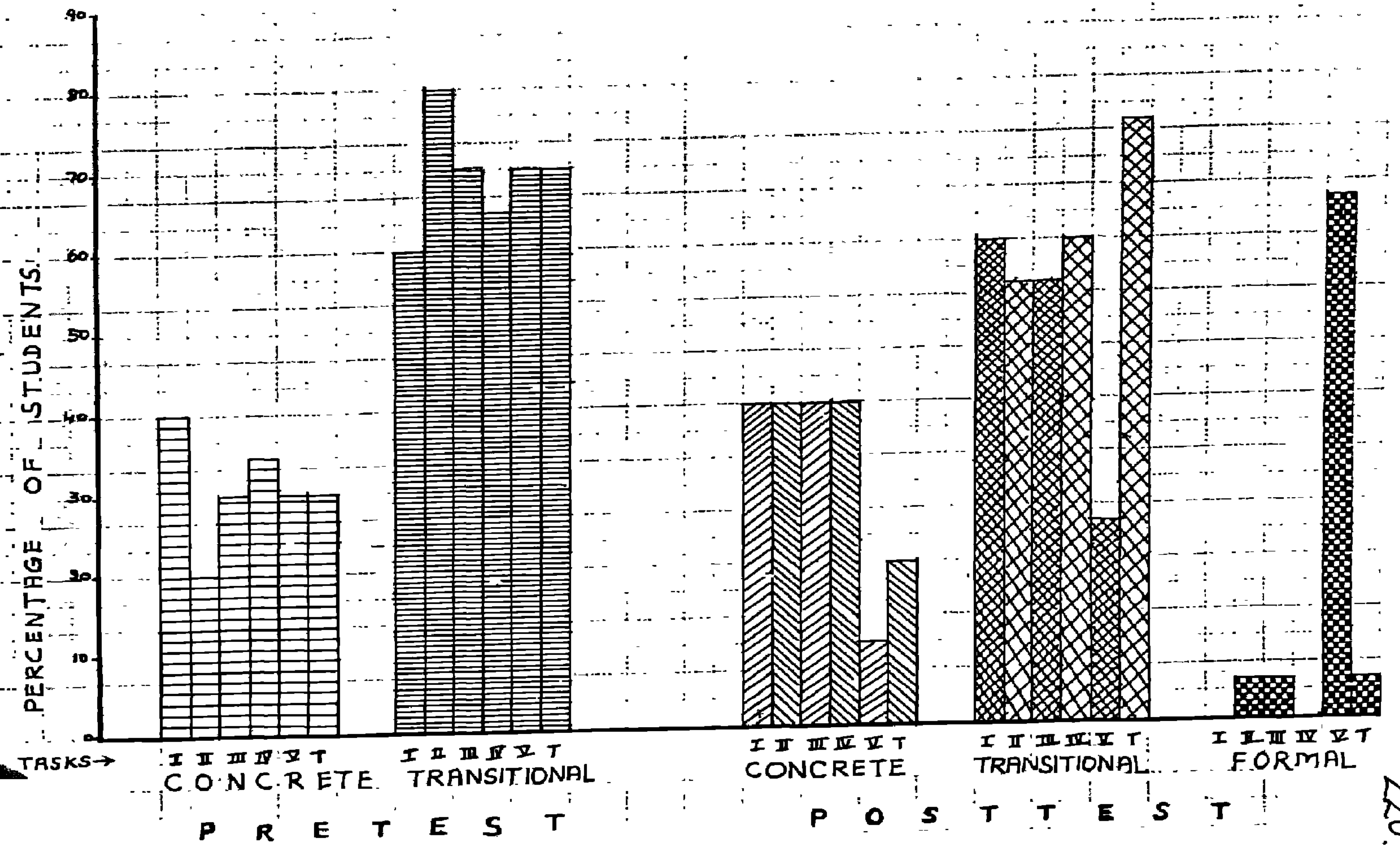
THE PERFORMANCE OF GIRLS OF EXPERIMENTAL GROUP - GRADE VIII - AGE 12+ FOR EACH TASK AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRETEST AND POST TEST.



EACH TASK AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRE-TEST AND POST-TEST.



THE PERFORMANCE OF GIRLS OF [illegible]
AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT FOR PRE-TEST AND POST-TEST



No. 5. In the total of all the tasks there is seen an improvement.

For grade IX age 13+ boys there is seen an improvement for all the tasks as depicted in the difference of scores between the Pre-test and the Post-test. In case of girls there is improvement in tasks No. 1, 2, 5 and total. The number of students decreasing in concrete level is distributed in the increase in the transitional and formal operational levels at the Post-test. Both the boys and girls for the fifth task reached the formal stage.

For grade X age 14+, boys there is not seen much improvement except for the fifth task. In case of girls there is seen an improvement for all the tasks. The girls attained the formal stage for tasks No.2, 3 and 5. The boys reached the formal stage only for the fifth task.

Thus, it is seen that majority of the students gained from the training, grade-wise, age-wise and sex-wise.

Performance of the students as a result of different mode of presentation :

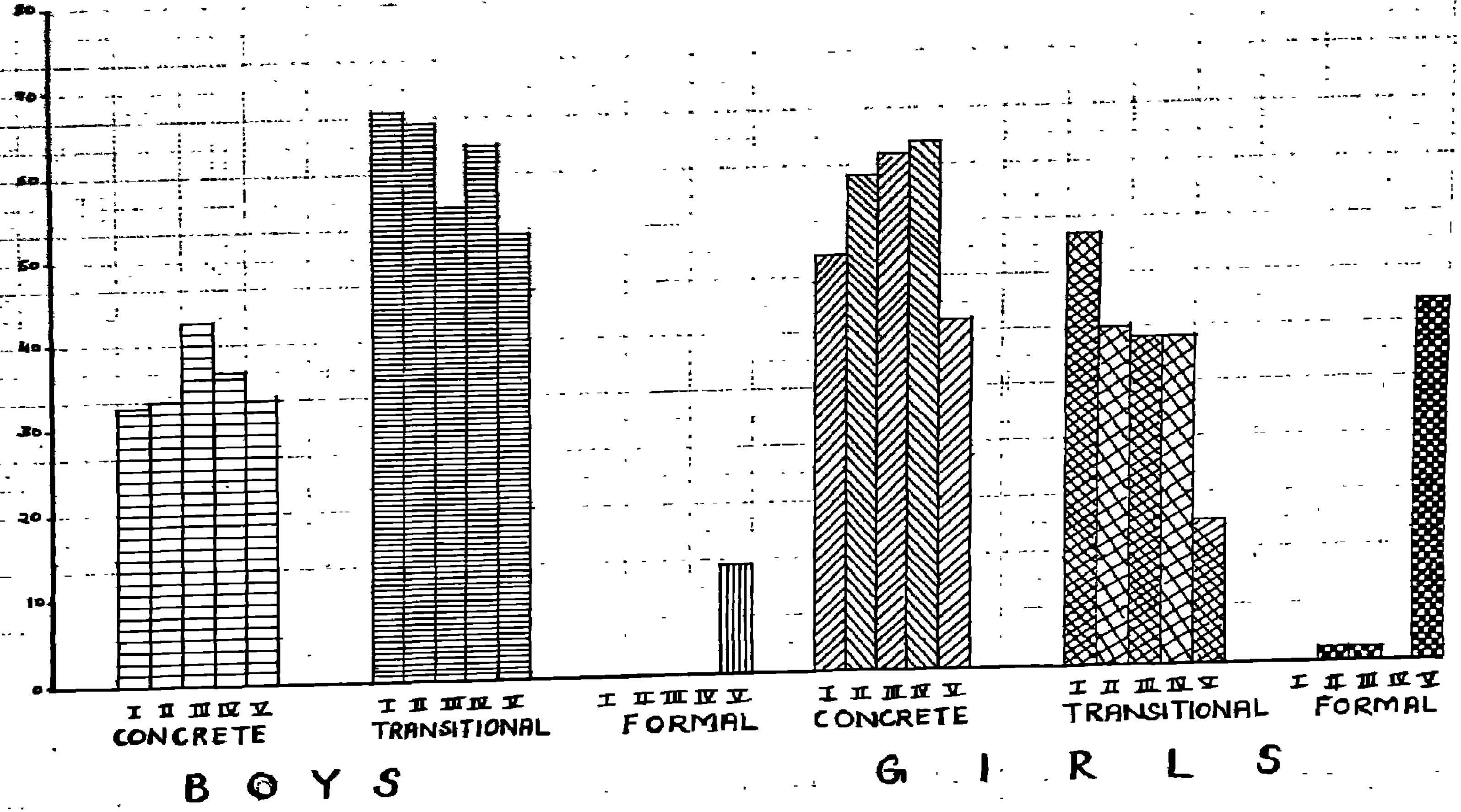
In this study four different modes of presentation were used during the training of five Piagetian task. For task one, the Wax problem, verbal instruction was given, for the second task, the bending of rod, and the third task, demonstration method was adopted. Each process of the problem was demonstrated with the help of various apparatus. The fourth problem,

Table No. 22

Percentage of the students' performance as a result of different mode of presentation

Mode of Presentation	Tasks	BOYS			GIRLS		
		C	T	F	C	T	F
Verbal presentation	1	32.39	67.61		49.33	50.67	
Demonstration	2	33.80	66.20		58.66	40.00	1.34
Demonstration	3	43.66	56.34		61.33	37.34	1.33
Pictorial	4	36.61	63.39		62.86	37.34	
Experimention	5	33.80	53.53	12.67	41.33	16.00	42.67

PERFORMANCE OF BOYS AND GIRLS FOR EACH TASK AT THE POST-TEST, USING DIFFERENT MODES OF PRESENTATION.



i.e., the flow of liquid through a tube, was presented pictorially. Various processes of this problem was delt with diagram only. The fifth problem i.e. the simple pendulum problem was carried out inthe form of experimental method. The class was divided into small groups. Each group handled the apparatus themselves. They tested their hypotheses and drew their conclusions.

The post-test scores of the experimental group is shown in Table No. 22 in the form of percentage. This is followed by a graph, through which that task in which the performance was higher than the others can be seen. Here it is seen that both the groups, boys and girls, performed better for task No.5 which means that presenting a problem by 'experimenting' is grasped better. The next mode of presentation which follows is demonstration method.

RESULTS OF LOWER GRADES:

This study was extended to the fifth and sixth grade. Since they do not fall in the adolescent group, they have been excluded from the main study.

Same Pre-test, Post-test and training techniques were used for these two lower grades. One problem posed was whether training can be equally effective for the children of lower age (in this case ages a+ and 10+) as supposed for the formal thinkers.

Table No.23

Performance of girls and boys of lower grades for Pre-test and Post-test of the control and the experimental group

GRADE/ AGE	Level of ID	CONTROL GROUP						EXPERIMENTAL GROUP					
		Task 1	Task 2	Task 3	Task 4	Task 5	Total	Task 1	Task 2	Task 3	Task 4	Task 5	Total
BOYS													
V 9+	C	19 (18)	16 (18)	15 (15)	11 (14)	13 (19)	12 (10)	20 (20)	17 (17)	20 (18)	12 (15)	15 (20)	13 (5)
	T	- (2)	4 (2)	5 (5)	9 (6)	7 (6)	8 (10)		3 (3)	- (2)	8 (5)	5 -	7 (15)
VI 10+	C	20 (19)	20 (16)	20 (19)	20 (15)	20 (20)	19 (13)	20 (20)	18 (16)	20 (20)	20 (20)	20 (20)	17 (5)
	T	- (1)	- (4)	- (1)	- (5)	-	1 (7)	-	2 (4)	-	8 (5)	-	3 (15)
GIRLS													
V 9+	C	20 (19)	20 (19)	19 (15)	20 (16)	19 (20)	19 (17)	18 (19)	19 (11)	18 (17)	17 (18)	15 (18)	16 (13)
	T	- (1)	- (1)	1 (5)	- (4)		1 (3)	2 (1)	1 (9)	2 (3)	3 (1)	4 (1)	4 (7)
VI 10+	C	20 (20)	10 (13)	20 (20)	20 (19)	15 (18)	10 (12)	20 (18)	20 (10)	20 (13)	19 (12)	20 (13)	14 (10)
	T		1 (6)		- (1)	- (1)	10 (8)	- (2)	- (9)	- (6)	- (7)	- (-)	6 (9)
	F											- (2)	- (1)

Figures in brackets denote the number of students at the post test

Table No.24

Difference in the mean and S.D. of Pre-test and Post-test scores for different tasks with respect to control and experimental group, sex-wise, grade-wise and age-wise

GRADES/ AGE	Level of ID	CONTROL GROUP						EXPERIMENTAL GROUP					
		Task 1	Taks 2	Taks 3	Task 4	Task 5	Total	Task 1	Task 2	Task 3	Task 4	Task 5	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
BOYS													
V 9+ C	Pre-test	0.95 (0.223)	1 (0)	1 (0)	1 (0)	1 (0)	5.666 (0.984)	1 (0)	1 (0)	1 (0.324)	0.833 (0.389)	1 (0)	5.230 (1.091)
	Post test	1.333 (0.485)	1.444 (0.511)	1.133 (0.351)	1.142 (0.662)	1.052 (0.621)	5.9 (0.994)	1.35 (0.489)	1.470 (0.624)	1.555 (0.511)	1.666 (0.487)	1.45 (0.510)	5.8 (1.095)
T	Pre-Test	- (-)	3 (0)	3 (0)	3 (0)	3 (0)	10.125 (1.642)		3 (0)	[illegible]	3 (0)	3 (0)	9.142 (0.899)
	Post test	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)	9.2 (0.788)		3 (0)	3 (0)	3 (0)		8.933 (0.833)
VI 10+ C	Pre-test	1.05 (0.223)	1.05 (0.003)	1.05 (0.323)	1.05 (0.223)	1 (0)	5 (0)	1.05 (0.394)	1.111 (0.523)	1.15 (0.366)	1.15 (0.489)	1.3 (0.571)	5.529 (0.874)
	Post test	1.210 (0.418)	1.06 (0.25)	1.05 (0.229)	1.06 (0.258)	1 (0)	5 (0)	1.55 (0.510)	1.812 (0.403)	1.35 (0.489)	1.7 (0.470)	1.65 (0.489)	5.6 (0.894)
T	Pre-test						9 (0)		3 (0)				9 (1)
	Post Test	3 (0)	3 (0)	3 (0)	3 (0)		9.142 (1.772)		3 (0)				9.6 (0.828)

Contd.....

1	2	3	4	5	6	7	8	9	10	11	12	13	14
G I R L S													
V 9+	C Pre-test	1.1 (0.307)	1.2 (0.410)	1.052 (0.524)	1.1 (0.307)	0.95 (0.223)	5.368 (1.011)	1 (0)	1 (0)	1 (0)	1 (0)	0.937 (0.25)	5.437 (0.813)
	C Post test	1 (0)	1 (0)	1 (0.377)	1.25 (0.447)	1.1 (0.307)	5.882 (0.927)	1 (0)	1.090 (0.301)	1.05 (0.242)	1.052 (0.404)	1 (0.333)	5.307 (0.751)
	T Pre-test			3 (0)			8 (0)	3 (0)	3 (0)	3 (0)	3 (0)	3 (0(	9 (0)
	T Post test	3 (0)	3 (0)	3 (0)	3 (0)		9.333 (1.527)	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)	9.1423 (0.899)
VII 10+	C Pre-test	1.5 (0.512)	1.526 (0.512)	1.45 (0.510)	1.25 (0.444)	1.1 (0.788)	5.3 (1.059)	1.4 (0.502)	1.4 (0.502)	1.25 (0.444)	1.2 (0.523)	1.2 (0.410)	5.357 (0.744)
	C Post test	1.3 (0.470)	1.214 (0.578)	1.35 (0.489)	1.263 (0.452)	1.368 (0.597)	6 (0.953)	1.222 (0.427)	1 (0.447)	1 (0.392)	1 (0.408)	1 (0.632)	4.9 (1.66)
	T Pre-test		3 (0)				8.6 (0.699)						9.0 (1.09)
	T Post test		3 (0)		3 (0)	3 (0)	9 (1.069)	3 (0)	3 (0)	3 (0)	3 (0)		10.55 (2.242)
	F Pre-test											4 (0)	1 -
	F Post test												

Figures in brackets are the S.D. value.

Table No. 22 gives an idea of the performance of these lower grades, both boys and girls. Twenty students matched on intelligence, socio-economic status and age, were selected from each grade. Thus, there were two grades each for control group and experimental group for boys and similar selection for girls. The total sample comprised of one hundred and sixty students.

The results drawn from Table No. 22 and No. 23 is that the performance (general) is better for sixth grade than the fifth grade. Also the test scores for Post-test, in both the control and the experimental group is better than the Pre-test scores. Another inferences drawn is that the Post-test scores of experimental group is better than the scores of the Post-test of control group, which means that the training helps not only children belonging to higher age group but also children belonging to lower age group. It is also seen that the performance of sixth grade is better than the students of fifth grade, so much so, that two students out of twenty were able to isolate irrelevant variables and point out the vital variable for the fifth task. This is basically formal thinking.

TRANSFER OF TRAINING :

One of the basis to find out whether training is effective is to determine the transfer of learning. For this purpose two other problems of the same schemes of thoughts

as the Pre-test and Post-test were administered with the Post-test. The first problem was of a boy diving from a diving board into the swimming pool. The students were to give the causative variables for bending of the diving board. The second problem was the spring problem. The displacement of the object pushed against the spring depended on which variables, was what the testee had to answer. Since this transfer study is not included in the main study, so a brief mention of the results is being made. It was seen that those students who were favourably influenced by training also showed favourable results for these two tests.

CHAPTER - V

RESULTS OF INTERNAL STATISTICAL ANALYSIS DISCUSSIONS AND CONCLUSIONS

INTRODUCTION

In the previous chapter the mean and standard deviations for various groups - age wise, sex wise, grade wise children at three levels of intellectual development and various personality traits for the various Piagetian tasks used in this study, namely, (i) The Wax Problem, (ii) The Bending of Rod Problem, (iii) The Ramp Problem, (iv) The Flow of Liquid Through a Tube, (v) The Simple Pendulum Problem, and the total scores of all these problems have been shown. In this chapter, the various hypotheses related to the study have been analysed according to various statistical techniques. Each hypotheses after being analysed is concluded.

HYPOTHESES

The main hypotheses considered for the study are as follows :

(1) There is no significant difference between the scores of Pre test and Post test for control and experimental group sex wise, age wise and grade wise.

(2) There is no significant difference between the scores of Pre-test and Post test for control and experimental group at the three levels of intellectual development, sex wise, grade wise and age wise.

(3) There is no significant difference in scores during the first and last training sessions for those levels of intellectual development as well as grade wise, sex wise and age wise.

(4) There is no significant difference in the modes of presentation of the problem.

(5) There is no significant relationship between the intelligence and Post test performance of control and experimental group for boys and girls.

(6) There is no significant relationship between the personality scores, intelligence and Post test scores for those students who are favourably influenced by training.

(7) There is no strong factorial or mathematical structure underlying the measures - intelligence, personality traits and scheme of thought in respect of those students showing favourable influence of training.

For convenience sake each hypothesis has been subdivided and analysed.

HYPOTHESIS No.1 :

There is no significant differences between the scores of Pre test and Post test for control and experimental group, sex wise, grade wise and age wise. The results looked for under this hypothesis are given below. Firstly, to find out the difference grade wise performance of the various groups, tasks and sex.

(1) There is no significant difference between each problem of Pre test and Post test of each grade of boys of control group.

(2) There is no significant difference between each problem of Pre test and Post test of each grade of boys of experimental group.

(3) There is no significant difference between the total scores of all the problems at Pre test and Post test of each grade of boys at control group.

(4) There is no significant difference between the total scores of all the problems at Pre test and Post test of experimental group.

(5) There is no significant difference between the scores of each problem for Pre test and Post test of each grade of girls of control group.

- - -

(6) There is no significant difference between the scores of each problem for Pre test and Post test of each grade of girls of experimental group.

(7) There is no significant difference between the total scores of all the problems for Pre-test and Post test of each grade of girls of control group.

(8) There is no significant difference between the total scores of all the problems for Pre test and Post test of each grade of girls of experimental group.

(9) There is no significant difference between the scores of each problem of Pre test of each grade of boys of control and experimental group.

(10) There is no significant difference between the total scores of all the problems for Pre test of each grade of boys of control and experimental group.

(11) There is no significant difference between the scores of each problem for each grades of girls of control and experimental group at Pre test.

(12) There is no significant difference between the total scores of all the problems at Pre test for each grade of girls of control and experimental group.

(13) There is no significant difference between the scores of each problem for Post test of each grade of boys of control and experimental group.

(14) There is no significant difference between the total scores of all the problems for Post test of each grade of boys of control and experimental group.

(15) There is no significant difference between the scores of each problem for Post test of girls for each grade of control and experimental group.

(16) There is no significant difference between the total scores of all the problems for Post test of each grade of control and experimental group.

(17) There is no significant difference between the scores of each problem for Pre test of boys and girls of each grade of control group.

(18) There is no significant difference between the total scores of all the problems for Pre test of boys and girls of each grade of control group.

(19) There is no significant difference between scores of each problems for Pre test of boys and girls of each grade of experimental group.

Table No. 25

HYPOTHESES RELATING TO THE DIFFERENCES IN THE PRE TEST AND POST TEST SCORES FOR DIFFERENT GRADES AND AGE OF THE CONTROL AND EXPERIMENTAL GROUP

GRADE/ AGE		CONTROL GROUP						EXPERIMENTAL GROUP					
		1	2	3	4	5	Total	1	2	3	4	5	Total
VII	No. of students	19	19	19	19	19	19	20	20	20	20	20	20
11+		19	19	19	19	19	19	20	20	20	20	20	20
	Difference in mean	0.3684	0.3158	0.2632	0.3157	0.3684	1.6316	0.25	0	0.1	0.05	0.25	0.2
	't' value	*2.6670	1.3569	1.3833	**2.3049	*2.6670	*2.8565	1.16842	0	0.5878	0.2629	1.3442	0.2835
VIII	No. of students	19	19	19	19	19	19	17	17	17	17	17	17
12+		19	19	19	19	19	19	17	17	17	17	17	17
	Difference in mean	0.1053	0.1579	0.1053	0.1053	0.2106	0.2632	0.2992	0.1765	0.1765	0.1177	0.5294	1.2942
	't' value	0.5829	0.9595	0.5185	0.4490	1.3078	0.34107	**1.7963	0.8708	1.6640	0.9997	*3.0876	1.6185
IX	No. of students	19	19	19	19	19	19	17	17	17	17	17	17
13+		19	19	19	19	19	19	17	17	17	17	17	17
	Difference in mean	0	0.5263	0.1052	0.3157	0.0526	0.7894	0.4705	0.5294	0.2941	0.2942	1.2353	2.82352
	't' value	0	**2.3869	0.5454	1.5436	0.3235	1.01986	**2.5788	*3.2594	**2.4273	*2.5832	*4.2214	*5.0597
X	No. of students	20	20	20	20	20	20	17	17	17	17	17	17
14+		20	20	20	20	20	20	17	17	17	17	17	17
	Difference in mean	0.1	0.1	0.25	0.15	0	0.25	0.24530	0.1765	0.1665	0.17647	0.705892	1.1177
	't' value	**2.1770	0.4419	1.2128	0.7894	0	0.3703	1.2794	0.7198	0.9638	0.9098	*2.7994	1.4292

* - Significant at 0.01 level
** - Significant at 0.05 level

(20) There is no significant difference between the total scores of all the problems for Pre test of boys and girls of each grade of experimental group.

(21) There is no significant difference between the scores of each problem of Post test of each grade of boys and girls of control group.

(22) There is no significant difference between the total scores for all the problem of Post test for each grade of boys and girls of control group.

(23) There is no significant difference between the scores of each problems of Post test for each grade of boys and girls of experimental group.

(24) There is no significant difference between the total scores of all the problems of Post test for each grade of boys and girls of experimental group.

PROCEDURE 't' VALUE

Mean and 't' value of boys and girls of Pre test and Post for both the control and experimental group for each grade was calculated.

RESULTS

1. Table No.25 shows that 't' value calculated for each problem of the various grades out of 20 't' value two

Table No. 26

HYPOTHESES RELATED TO THE DIFFERENCE IN THE PRE TEST AND POST TEST SCORES FOR DIFFERENT GRADES AND AGE OF GIRLS OF THE CONTROL AND THE EXPERIMENTAL GROUP

GRADE/ AGE		CONTROL GROUP						EXPERIMENTAL GROUP					
		1	2	3	4	5	Total	1	2	3	4	5	Total
VII 11+	No. of students	17	17	17	17	17	17	18	18	18	18	18	18
		17	17	17	17	17	17	18	18	18	18	18	18
	Difference in mean	0.3529	0.3530	0.1764	0.1765	0	1.0589	1.1667	0.555	0.3888	0.3888	0.333	2.8333
	't' value	1.3217	1.4048	1.4549	1.1550	0	1.6295	*4.8033	**2.5544	**2.1214	**2.1214	1.4575	*7.5570
VIII 12+	No. of students	20	20	20	20	20	20	20	20	20	20	20	20
		20	20	20	20	20	20	20	20	20	20	20	20
	Difference in mean	0.2	0.1	0.15	0.25	0.3	1	0.55	0.6	0.5	0.45	1.5	0.6
	't' value	1.3785	0.4904	0.98876	**1.8228	**2.2769	1.6384	*4.819	*8.8975	*4.3589	*3.9439	*4.3160	1.03421
IX 13+	No. of students	20	20	20	20	20	20	17	17	17	17	17	17
		20	20	20	20	20	20	17	17	17	17	17	17
	Difference in mean	0.3	0.1	0.2	0.25	0.20	1.15	0.1177	0.5883	0.5291	0.1177	0.2941	1.4119
	't' value	**2.0426	0.71666	1.3788	1.7073	1.4633	**1.9635	0.6220	*3.9260	*2.8096	0.6864	0.9489	1.6845
X 14+	No. of students	18	18	18	18	18	18	20	20	20	20	20	20
		18	18	18	18	18	18	20	20	20	20	20	20
	Difference in mean	0.6667	0.2777	0.0556	0.3333	0.0556	1.2777	0	0.1	0.6	0.10	1.35	1.75
	't' value	*3.3669	1.2124	0.2854	1.5650	0.2361	**1.8522	0	0.4967	*3.4022	0.6333	**4.5707	**2.2319

* = Significant at 0.01 level
** = Significant at 0.05 level

were found to be significant at .01 and 3 were found to be significant at .05 level. Hence, Hypothesis No. 1 is accepted.

2. For the total of all the problems all the three 't' values were insignificant. One was significant at .05 level. Hypothesis No. 2 is accepted.

3. Table No.25 shows that 't' values were significant at .01 level and three were significant at .05 level.

4. For the total of all the problems one 't' value was found to be significant at .01 level hence hypothesis No.4 is accepted.

5. Table No.26 shows three 't' values were significant at .05 level and one at .01 level. Hence, hypothesis No.5 is accepted.

6. For total of all the problems two 't' values were found to be significant at .05 level, hence hypothesis No.7 is accepted.

7. Table.No.26 shows that out of 20 't' values ten were found to be significant at .01 level and three were significant at .05 level. So hypothesis No.6 is rejected.

8. For the total of all the problems one 't' value was significant at .01 and .05 level each hence hypothesis No.8 is rejected.

Table No.27

HYPOTHESES RELATED TO THE DIFFERENCE BETWEEN THE PRE TEST SCORES FOR EACH GRADE OF THE CONTROL AND THE EXPERIMENTAL GROUP OF BOYS AND GIRLS

GRADE/ AGE		BOYS						GIRLS					
		1	2	3	4	5	Total	1	2	3	4	5	Total
VII 11+	No.of students C	19	19	19	19	19	19	17	17	17	17	17	17
	E	20	20	20	20	20	20	18	18	18	18	18	18
	Difference in mean	0.2948	0.1816	0.1369	0.34474	0.44474	1.4027	0.2974	0.4117	0.6588	0.1764	0	1.1800
	't' value	**2.2059	0.94345	0.89628	**2.5518	*2.9005	**2.4572	1.4986	**2.74527	0.00345	1.8512	0	*3.1020
VIII 12+	No.of Student C	19	19	19	19	19	19	20	20	20	20	20	20
	E	17	17	17	17	17	17	20	20	20	20	20	20
	Difference in mean	0.0095	0.0093	0.1486	0.06815	0.3901	0.4170	0.15	0.1	0.2	0.15	0.05	0.65
	't' value	0.29012	0.04465	0.75140	0.29291	**2.16990	0.50770	0.93695	0.5677	1.2856	0.9672	0.3129	1.1167
IX 13+	No.of students C	19	19	19	19	19	19	20	20	20	20	20	20
	E	17	17	17	17	17	17	17	17	17	17	17	17
	Difference in mean	0.06192	0.21363	0.8049	0.2848	0.20930	0.6388	0.3823	0.58235	0.7588	0.3735	0.4735	2.5705
	't' value	0.3376	1.0580	0.5279	1.7493	0.5176	1.1728	**2.0657	*3.2431	*3.71052	**2.17644	*2.8094	*3.6172
X 14+	No.of students C	20	20	20	20	20	20	18	18	18	18	18	18
	E	17	17	17	17	17	20	20	20	20	20	20	20
	Difference in mean	0.2029	0.1970	0.0794	0.1939	0.3794	0.9205	2.687	0.1406	0.4166	0.3723	0.0889	0.7941
	't' value	1.2525	0.83531	0.37690	0.3183	**2.5417	1.1971	1.6636	0.63231	*2.8300	**2.1412	0.50041	1.1794

* = Significant at 0.01 level
** = Significant at 0.05 level

Table No.28

HYPOTHESES RELATED TO THE DIFFERENCE BETWEEN THE POST TEST SCORES FOR EACH TASK GRADE WISE OF CONTROL AND EXPERIMENTAL GROUP OF BOYS AND GIRLS

GRADE/ AGE		BOYS						GIRLS					
		1	2	3	4	5	Total	1	2	3	4	5	Total
VII 11+	No.of students C	19	19	19	19	19	19	17	17	17	17	17	17
	E	20	20	20	20	20	20	18	18	16	18	18	18
	Difference in mean	0.12642	0.1342	0.2263	0.02105	0.1736	0.4289	0.5164	0.2092	0.1536	0.0359	0.0981	0.5947
	't' value	0.65712	0.5792	1.1067	0.10989	0.9996	0.6077	1.7127	0.7062	0.7261	0.1642	0.3667	0.7379
VIII 12+	No.of students C	19	19	19	19	19	19	20	20	20	20	20	20
	E	17	17	17	17	17	17	20	20	20	20	20	20
	Difference in mean	0.23840	0.3437	0.1332	0.0805	0.34992	1.1455	0.2	0.4	0.15	0.05	1.65	1.25
	't' value	0.996	**2.18337	0.70379	0.39882	**2.3108	1.50813	**2.1795	**2.6289	1.3710	0.5675	*5.5158	1.7254
IX 13+	No.of students C	19	19	19	19	19	19	20	20	20	20	20	20
	E	17	17	17	17	17	17	17	17	17	17	17	17
	Difference in mean	0.53251	0.2167	0.4799	0.26316	1.4062	2.7832	0.8	0.8	0.7823	0.5058	0.8676	3.9555
	't' value	*5.12170	1.1712	*2.8328	1.58404	*5.3817	*3.9260	*5.2613	*0.19690	*5.3489	*3.4583	*2.94618	*5.1955
X 14+	No.of students C	20	20	20	20	20	20	18	18	18	18	18	18
	E	17	17	17	17	17	17	20	20	20	20	20	20
	Difference in mean	0.3382	0.4735	0.1529	0.3882	1.0852	2.2882	0.40	0.1112	0.1278	0.0611	1.4945	0.9723
	't' value	1.8805	**2.0464	0.91456	**2.0435	*4.6395	*3.3167	1.9062	0.5788	0.5871	0.3052	*4.4997	1.1297

* = Significant at 0.01 level
** = Significant at 0.05 level

9. Table No.27 shows that out of 20 't' value for boys only four were found to be significant at 0.05 level and one was significant at 0.01 level.

10. For the total of all the problems only one 't' value was significant at 0.05 level hence hypothesis No.10 is accepted.

11. From table No.27 four 't' value was found to be significant at 0.05 level and 0.01 each, hence hypothesis No.11 is rejected.

12. The total of all the problems only two 't' values were found to be significant at 0.01 level, hence hypothesis No.12 is accepted.

13. From Table No.28 three 't' values were found to be significant at 0.05 level and two were significant at 0.01 level hence hypothesis No.13 is accepted.

14. For the total of all the problems one 't' value was found to be significant at 0.05 level and two were significant at 0.01 level, hence hypothesis No.14 is rejected.

15. From Table No.28 two 't' value were found to be significant at 0.05 level and seven were significant at 0.01 level, hence hypothesis No.15 is rejected.

Table No.29

HYPOTHESES RELATED TO DIFFERENCE BETWEEN THE SCORES OF EACH PROBLEM FOR PRE TEST OF BOYS AND GIRLS OF EACH GRADE OF CONTROL AND EXPERIMENTAL GROUP

GRADE/ AGE		CONTROL GROUP						EXPERIMENTAL GROUP					
		1	2	3	4	5	Total	1	2	3	4	5	Total
VII 11+	No.of students	17 19	17 19	17 19	17 19	17 19	17 19	18 20	18 20	18 20	16 20	18 20	18 20
	Difference in mean	0.2477	0.0433	0.2043	0.0712	0.1300	0.2879	0.3445	0.55	0.4	0.45	0.55	2.2945
	't' value	1.21547	0.2131	1.7168	0.5953	0.4431	0.5374	*2.7481	*4.0679	*3.5593	*3.9437	*4.0679	*4.9476
VIII 12+	No.of students	20 19	20 19	20 19	20 19	20 19	20 19	20 17	20 17	20 17	20 17	20 17	20 17
	Difference in mean	0.020	0.0789	0.4366	0.2789	0.2842	1.1	0.0795	0.0118	0.0882	0.19705	0.1159	0.0382
	't' value	0.1298	0.4413	**2.6258	1.4642	1.6108	1.5933	0.4703	0.0675	0.18077	0.96265	0.8540	0.0530
IX 13+	No.of students	20 19	20 19	20 19	20 19	20 19	20 19	17 17	17 17	17 17	17 17	17 17	17 17
	Difference in mean	0.0263	0.0157	0.3842	0.020	0.0710	0.4684	0.2940	0.3529	0.2941	0.1176	0.2941	1.3528
	't' value	0.1601	0.0928	**2.2833	0.1291	0.4448	0.7421	1.4085	1.6804	1.5341	0.6859	1.3608	1.6857
X 14+	No.of students	18 20	18 20	18 20	18 20	18 20	18 20	20 17	20 17	20 17	20 17	20 17	20 17
	Difference in mean	0.1833	0.1611	0.2166	0.0723	0.4611	0.95	0.2471	0.153	0.2794	0.2382	0.1706	0.5294
	't' value	1.1583	0.6520	0.3346	0.3579	**2.2236	1.277	1.5065	1.0157	1.79715	1.4490	1.4456	0.6490

* = Significant at 0.01 level
** = Significant at 0.05 level

Table No.3D

HYPOTHESES RELATED TO DIFFERENCE BETWEEN THE POST TEST SCORES OF BOYS AND GIRLS OF CONTROL [illegible] EXPERIMENTAL GROUP

GRADE/ AGE		CONTROL GROUP						EXPERIMENTAL GROUP					
		1	2	3	4	5	Total	1	2	3	4	5	Total
VII 11+	No.of students	17 19	17 19	17 19	17 19	17 19	17 19	18 20	16 20	15 20	18 20	18 20	18 20
	Difference in mean	0.2322	0.0805	0.2911	0.0681	0.2384	0.2848	0.6222	0.0055	0.0888	0.0112	0.0333	0.7388
	't' value	1.0505	0.29192	1.51870	0.40836	1.6541	0.40683	**2.2129	0.0179	0.1126	0.0141	0.12722	0.91114
VIII 12+	No.of students	20 19	20 19	20 19	20 19	20 19	20 19	20 17	20 17	20 17	20 17	20 17	20 17
	Difference in mean	0.3263	0.021[illegible]	0.1315	0.6342	0.3736	1.8368	0.7642	0.7647	0.7642	0.7642	0.1264	1.9325
	't' value	1.94619	0.109[illegible]	0.6874	*3.2837	*2.7408	*2.6002	*7.2128	*7.2128	*7.2119	*7.2119	0.3700	*2.8621
IX 13+	No.of students	20 19	20 19	20 19	20 19	20 19	20 19	17 17	17 17	17 17	17 17	17 17	17 17
	Difference in mean	0.32631	0.6421	0.4789	0.5368	0.2184	2.2077	0.0588	0.0588	0.1765	0.1137	0.5471	1.2353
	't' value	1.7720	*3.5003	*2.7670	*2.6007	1.5587	*2.9937	0.3682	0.3682	1.1241	**2.5855	0.1485	1.6834
X 14+	No.of students	18 20	18 20	18 20	18 20	18 20	18 20	20 17	20 17	20 17	20 17	20 17	20 17
	Difference in mean	0.05	0.5388	0.5222	0.4111	0.4055	2.4777	0.01177	0.1118	0.4971	0.0382	0.6141	0.7618
	't' value	0.2635	**2.6104	**2.6648	**2.0389	2.0066	*4.0264	0.06272	0.47850	**2.4264	0.20267	**2.3101	0.8322

* = Significant at 0.01 level
** = Significant at 0.05 level

16. For total of all the problems one 't' value was found to be significant at 0.01 level, hence hypothesis No.16 is accepted.

17. From Table No.29 three 't' values were found to be significant at 0.05 level for the control group, hence hypothesis No.17 is accepted.

18. For the total of all the problems no 't' value was found to be significant, hence hypothesis No.18 is accepted.

19. From Table No.29, five 't' values were found to be significant at 0.01 level. Hence hypothesis No.19 is accepted.

20. For the total of all the problems one 't' value was found to be significant at 0.01 level, hence hypothesis No.20 is accepted.

21. From Table No. 30 five 't' values were found to be significant at 0.01 level and three were significant at 0.05 level, hence hypothesis No. 21 is rejected.

22. For the total of all the problems three 't' values were found to be significant at 0.01 level. Hence hypothesis No.22 is rejected.

23. From Table No.30 four 't' values found to be significant at 0.05 level and four at 0.01 level. Hence, hypothesis No. 23 is rejected.

24. One 't' value for the total of all the problems was found to be significant at 0.01 level. Hence hypothesis No.24 is accepted.

HYPOTHESIS No. 2

There is no significant difference between the experimental and control group for the three levels of intellectual development during Pre test and Post test. The findings looked for under this hypothesis are as follows :

(1) There is no significant difference in each problem of Pre test at the three level of intellectual development for boys of control and experimental group.

(2) There is no significant difference in the total scores of all the problems of Pre-test at the three levels of intellectual development for boys of control and experimental group.

(3) There is no significant difference in each problem of Pre test at the three levels of intellectual development for girls of control and experimental group.

(4) There is no significant difference in the total of the all the problems of Pre test at the three levels of intellectual development for girls of control and experimental group.

(5) There is no significant difference in each problem of Post test at the three levels of intellectual development for boys at the control and experimental group.

(6) There is no significant difference in the total scores of all the problems of the Post test for the three levels of intellectual development for boys of control and experimental group.

(7) There is no significant difference in scores of each problem of Post test for the three levels of intellectual development for girls of control and experimental group.

(8) There is no significant difference in the total scores of all the problems of Post test at the three levels of intellectual development of girls of control and experimental group.

(9) There is no significant difference in scores of each problem of Pre test and Post test of boys of control group at the three levels of intellectual development.

(10) There is no significant difference in the total scores of all the problems of Pre test and Post test for boys of control group at the three levels of intellectual development.

(11) There is no significant difference in scores of each problem of the Pre test and Post test of boys of experimental group at the three levels of intellectual development.

(12) There is no significant difference in total scores of all the problems of Pre test and Post test of boys of experimental group at the three levels of intellectual development.

(13) There is no significant difference in the scores of each problem of girls at Pre test and Post test of control group at three levels of intellectual development.

(14) There is no significant difference in the total scores of all the problems of control group for girls at the three levels of intellectual development.

(15) There is no significant difference in the scores of each problem of Pre test for girls of experimental group at the three levels of intellectual development.

(16) There is no significant difference in the total scores of all the problems of pre test and Post test for girls of experimental group at the three levels of intellectual development.

(17) There is no significant difference in the scores of each problem for Pre test of boys and girls of control group at the three levels of intellectual development.

(18) There is no significant difference in the total scores of all the problems for Pre test of boys and girls of

control group at the three levels of intellectual development.

(19) There is no significant difference in the scores of each problem of boys and girls during Post test at the three levels of intellectual development of control group.

(20) There is no significant difference in the total scores of all the problems of boys and girls of control group at three levels of intellectual development.

(21) There is no significant difference in the scores of each problem of Pre test of experimental group for boys and girls at the three levels of intellectual development.

(22) There is no significant difference in the total of all the problems of Pre test of experimental group for boys and girls at the three levels of intellectual development.

(23) There is no significant difference in each problem for the Post test of experimental group of boys and girls at the three levels of intellectual development.

(24) There is no significant difference in the scores of total problems of experimental group for boys and girls at the three levels of intellectual development.

Table No. 31

HYPOTHESES RELATED TO THE DIFFERENCES IN THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT AND THE PERFORMANCE OF CONTROL AND EXPERIMENTAL GROUP OF BOYS DURING PRE TEST

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of students	Difference in means	't' value	No. of students	Difference in means	't' value	No.of students	Difference in means	't' value
1	76 71	.17439	**2.1457	1 0	3	£	0 0	0	0
2	73 67	.17992	**2.0557	0 4	0	0	0 0	0	0
3	73 70	.0908	1.0824	4 1	0	0	0 0	0	0
4	74 69	.20995	**2.57519	3 2	0	0	0 0	0	0
5	77 71	.14121	1.5672	0 0	0	0	0 0	0	0
Total	49 32	.04146	0.2216	26 39	.14093	.61825	0 0	0	0

* = Significant at 0.01 level
** = Signifixant at 0.05 level

Table No. 3a

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE INTELLECTUAL LEVELS AND THE PERFORMANCE OF GIRLS OF CONTROL AND EXPERIMENTAL GROUP DURING PRE TEST

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No. of student	Difference in means	't' value	No. of student	Difference in means	't' value	No. of student	Difference in means	't' value
1	72 73	.14615	1.7996	3 2	0	0	0 0	0	0
2	73 73	.15068	1.7257	2 2	0	0	0 0	0	0
3	74 71	.1680	**2.0846	1 4	0	0	0 0	0	0
4	75 74	.1527	1.8754	0 1	3	E	0 0	0	0
5	75 74	.0729	0.87110	0 1	3	E	0 0	0	0
Total	45 46	.13889	0.9505	30 38	.5649	*2.8777	0 0		

* = Significant at 0.01 level

** = Significant at 0.05 level

E = infinity

Table No.33

HYPOTHESES RELATING TO THE DIFFERENCE IN THE THREE LEVEL OF INTELLECTUAL DEVELOPMENT DURING THE PERFORMANCE OF POST TEST FOR CONTROL AND EXPERIMENTAL GROUP OF BOYS

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in means	't' value	No.of student	Difference in means	't' value	No.of student	Difference in means	't' value
1	75 66	.2515	*3.0643	2 5	0	0	0 0	0	0
2	73 67	.2999	*3.4941	4 4	0	0	0 0	0	0
3	68 69	.1975	**2.3475	9 2	0	0	0 0	0	0
4	70 68	.2605	*3.1471	7 3	0	0	0 0	0	0
5	77 61	.2101	**2.3998	0 1	3	E	0 9	4	E
Total	41 23	.18875	1.0855	36 43	.6666	*3.5334	0 0	0	0

* = Significant at 0.01 level
** = Significant at 0.05 level

E = infinity

Table No.34

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE LEVEL OF INTELLECTUAL DEVELOPMENT DURING THE PERFORMANCE OF GIRLS FOR POST TEST FOR EXPERIMENTAL AND CONTROL GROUP

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Differance in means	't' value	No.of student	Difference in means	't' value	No.of student	Difference in means	't' value
1	68 61	.0241	.28162	7 14	0	0	0 0	0	0
2	66 65	.0053	.0638	9 9	0	0	0 1	4	E
3	73 69	.0577	0.7412	2 5	0	0	0 1	4	E
4	73 72	.08675	1.1117	2 3	0	0	0 0	0	0
5	71 47	.0299	.17325	3 -	3	E	1 28	0	0
TOTAL	50 25	.04	.1952	25 49	.1164	.3127	0 1	17	E

* = Significant at 0.01 level
** = Significant at 0.05 level

E = infinity

Table No. 35

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE LEVEL OF INTELLECTUAL DEVELOPMENT AND THE PERFORMANCE OF BOYS OF CONTROL GROUP DURING PRE TEST AND POST TEST

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in means	't' value	No.of student	Difference in means	't' value	No.of student	Difference in means	't' value
1	76 75	.12368	1.6089	1 2	0	0	0 0	0	0
2	73 73	0	0	4 4	0	0	0 0	0	0
3	73 68	.0844	1.0155	4 9	0	0	0 0	0	0
4	74 70	.0598	0.7554	3 7	0	0	0 0	0	0
5	77 77	.0259	0.0773	0 0	0	0	0 0	0	0
TOTAL	49 41	.04679	0.2756	22 26	.3141	1.0840	0 0	0	0

* = Significant at 0.01 level   E = infinity

** = Significant at 0.05 level

Table No.36

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE INTELLECTUAL LEVELS AND THE PERFORMANCE OF BOYS OF EXPERIMENTAL GROUP FOR PRE TEST AND POST TEST

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in means	't' value	No.of student	Difference in means	't' value	No.of student	Difference in means	't' value
1	71 66	.2008	**2.3293	0 5	3	3	0 0	0	0
2	67 67	.1194	1.4019	4 4	0	0	0 0	0	0
3	70 69	.0223	0.0849	1 2	0	0	0 0	0	0
4	69 68	.1104	1.3254	2 3	0	0	0 0	0	0
5	71 61	.0949	0.9592	0 1	3	3	0 9	4	E
TOTAL	32 23	.12342	0.9612	39 48	.8397	*3.5549	0 0	0	0

* = Significant at 0.01 level

** = Significant at 0.05 level

E = infinity

Table No. 37

HYPOTHESES RELATED TO THE DIFFERENCE BETWEEN THE THREE INTELLECTUAL LEVELS AND THE PERFORMANCE OF GIRLS OF CONTROL GROUP DURING PRE TEST AND POST TEST

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in mean	't' value	No.of student	Difference in mean	't' value	No.of student	Difference in mean	't' value
1	72 68	.0196	.2429	3 7	0	0	0 0	0	0
2	73 66	.03508	*4.90217	2 9	0	0	0 0	0	0
3	74 73	.0642	0.8365	1 2	0	0	0 0	0	0
4	75 73	.06008	0.21415	0 2	3	E	0 0	0	0
5	75 71	.17464	**2.1664	0 3	3	E	0 1	4	E
TOTAL	45 50	.0356	0.21843	30 25	.6534	**2.0159	0 0	0	0

* = Significant at 0.01 level

** = Significant at 0.05 level

E = infinity

Table No. 38

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE INTELLECTUAL LEVELS AND THE PERFORMANCE OF OF GIRLS OF EXPERIMENTAL GROUP FOR PRE TEST AND POST TEST

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in mean	't' value	No. of student	Difference in mean	't' value	No.of student	Difference inmean	't' value
1	73 61	.10240	1.1919	2 14	0	0	0 0	0	0
2	73 65	.1803	**2.1517	2 9	0	0	0 1	4	E
3	74 69	.1745	**2.1354	1 5	0	0	0 1	4	E
4	75 72	.1261	1.5605	0 3	3	E	0 0	0	0
5	74 47	.2176	*2.5052	1 0	3	E	0 28	0	0
TOTAL	35 25	.21445	1.1255	38 49	.2045	.6809	0 1	17	E

E = infinity

* = Significant at 0.01 level
** = Significant at 0.05 level

Table No. 39

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE INTELLECTUAL LEVELS OF DEVELOPMENT AND THE PERFORMANCE OF CONTROL GROUP DURING PRE TEST AND POST TEST BOYS AND GIRLS

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in mean	't' value	No. of student	Difference in mean	't' value	No.of student	Difference in mean	't' value
1	76 72	.05715	.75073	1 3	0	0	0 0	0	0
2	73 73	.0411	.47989	4 2	0	0	0 0	0	0
3	73 74	.14125	1.76909	4 1	0	0	0 0	0	0
4	74 75	.00937	.116507	3 0	3	Σ	0 0	0	0
5	77 75	.06234	.77056	0 0	0	0	0 0	0	0
TOTAL	49 45	.0453	.2898	26 30	.20263	.35770	0 0	0	0

* = Significant at 0.01 level

** = Significant at 0.05 level

Σ = infinity

Table No. 40

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT AND THE PERFORMANCE OF CONTROL GROUP OF BOYS AND GIRLS DURING POST TEST

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in mean	't' value	No.of student	Difference in mean	't' value	No.of student	Difference in mean	't' value
1	75 68	.0471	2.77572	2 7	0	0	0 2	0	0
2	73 66	.00608	0.07111	4 9	0	0	0 0	0	0
3	68 73	.09583	1.19517	9 2	0	0	0 0	0	0
4	70 73	.11057	1.39444	7 2	0	0	0 0	0	0
5	77 71	.13828	1.79405	0 3	3	E	0 1	4	E
TOTAL	41 50	.35658	0.32207	36 25	.13667	.40076	0 0	0	0

* = Significant at 0.01 level
** = Significant at 0.05 level

E = infinity

Table No. 41

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE INTELLECTUAL LEVELS AND THE PERFORMANCE OF EXPERIMENTAL GROUP DURING THE PRE TEST OF BOYS AND GIRLS

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in mean	't' value	No.of student	Difference in mean	't' value	No.of student	Difference in mean	't' value
1	71 73	.02875	.33409	0 2	3	E	0 0	0	0
2	67 73	.0119	.13989	4 2	0	0	0 0	0	0
3	70 71	.0435	.01410	1 4	0	0	0 0	0	0
4	69 74	.0477	.5788	2 1	0	0	0 0	0	0
5	71 74	.00586	.0632	0 1	3	E	0 0	0	0
TOTAL	32 36	.2257	1.2746	39 36	.22132	1.16708	0 0	0	0

E = infinity

Table No. 42

HYPOTHESES RELATED TO THE DIFFERENCE IN THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT DURING THE PERFORMANCE OF BOYS AND GIRLS OF EXPERIMENTAL GROUP AT POST TEST

PROBLEM	CONCRETE			TRANSITIONAL			FORMAL		
	No.of student	Difference in mean	't' value	No.of student	Difference in mean	't' value	No.of student	Difference in mean	't' value
1	66 61	.27446	*3.18957	5 14	0	0	0 0	0	0
2	67 65	.28795	*3.42821	4 9	0	0	0 1	4	E
3	69 69	.26087	*3.18053	2 5	0	0	0 1	4	E
4	68 72	.28434	*3.4858	3 3	0	0	0 0	0	0
5	61 47	.31845	*3.40379	1 0	3	E	9 28	0	0
TOTAL	23 25	.1722	.84704	48 49	.4133	1.2458	0 1	17	E

* = Significant at 0.01 level
** = Significant at 0.05 level

E = infinity

PROCEDURE 't' VALUE

Mean and 't' value of boys and girls of Pre test and Post test for both the control and experimental group for the three levels of intellectual development were calculated.

RESULTS :

1. Table No.31 shows that three 't' values were significant at 0.05 level and that also only for the control level.

2. The 't' value for total of all the problems the value was not significant.

3. Table No.32 shows that out of five 't' values for each problem only one is significant at 0.05 level for the concrete level.

4. The 't' value of total one was significant at 0.01 level that also for transitional level.

5. Table No.33 shows that 't' value for each problem only three were found to be significant at 0.01 level and two were found to be significant at 0.01 level. All these significant values were for the concrete level.

6. For the 't' value of total only one was found significant at 0.01 level. This was so for the transitional level.

7. From table No.34 out of all the 't' values one was significant.

8. For 't' value of total not a single one was found to be significant.

9. From table No.35 out of the all the 't' values calculated not a single one was found to be significant.

10. 't' value tabulated for the total of all problems was not found to be significant.

11. From Table No.36 out of all the 't' values one was found to be significant at 0.05 level as observed for the concrete level.

12. For the two 't' values of total one was found to be significant at 0.01 level.

13. From table No.37 out of all the 't' values one was found to be significant at 0.05 level and one was significant at 0.01 level and that too only for the concrete level.

14. For the two 't' values of the total score one was found to be significant at 0.05 level for the transitional level.

15. From Table No.38 out of all the 't' values calculated two were found to be significant at 0.05 level and one at 0.01 level. All these were for the concrete level.

16. For the 't' value of the total scores no value was found to be significant.

17. From Table No.39 out of all the 't' values for each problem none was found to be significant.

18. For the 't' value of total scores not a single value was found to be significant at 0.01 or 0.05 level.

19. From Table No.40 out of all the 't' values not a single one was significant.

20. For the 't' value of the total scores none was found to be significant.

21. From Table No. 41 out of all the 't' values none was found to be significant.

22. For 't' value of total none was found to be significant.

23. From Table No. 42 out of all the 't' values five were found to be significant at 0.01 level for the concrete level.

24. For 't' value of total scores no value was found to be significant.

HYPOTHESIS No.3

There is no significant difference during the first and the last training session of boys and girls of experimental group for the three levels of intellectual development as well as sex wise, grade wise and age age. The findings looked for under this hypothesis are as follows ;

1. There is no significant difference in the scores of each problem for first and last training session of boys at the three level of intellectual development.
2. There is no significant difference in the total scores of all the problems for the first and last training session of boys at the three level of intellectual development.
3. There is no significant difference in the scores of each problem for first and last training session of girls at the three level of intellectual development.
4. There is no significant difference in the total scores of all the problems for the first and last training session of girls at the three level of intellectual development.
5. There is no significant difference in the scores of each problem of boys and girls for the first and last training session.

6. There is no significant difference in the total scores of all the problems of boys and girls for first and last training session.

7. There is no significant difference in the scores of each problem of boys in each grade for the first and last training session.

8. There is no significant difference in the total of the problems of boys in each grade for the first and last training session.

9. There is no significant difference in the scores of each problem of girls in each grade for the three training session.

10. There is no significant difference in the total scores of all the problems of girls in each grade for the three training session.

PROCEDURE 't' VALUE

Mean and 't' value of boys and girls of first and last training session for only experimental group for each grade age as well as the three level of intellectual development was calculated. Only experimental group was given consideration because training was imparted only to the experimental group and not the control group.

Table No. 43

DIFFERENCE IN THE SCORES OF EACH PROBLEM FOR FIRST AND LAST TRAINING SESSION AT THE THREE LEVELS OF INTELLECTUAL DEVELOPMENT OF BOYS AND GIRLS

GROUPS	TASKS	CONCRETE			TRANSITIONAL			FORMAL		
		No. of students	Difference in mean	't' value	No. of students	Difference in mean	't' value	No. of students	Difference in mean	't' value
BOYS	1	11	0.1111	0.20074	57	0.114035	0.83456	2	0	0
		9			38			24		
	2	9	0.5554	0.75517	55	0.63165	*3.06605	7	0.14294	0.52537
		0			27			35		
	3	21	0.7	0.37016	48	0.13336	0.46644	2	0.12934	1.00006
		10			30			31		
	4	29	1.07758	1.54843	42	0.25143	0.77138	0	17.60714	*135.9624
		16			25			28		
	5	31	0.15568	0.34543	39	0.20103	0.84121	1	0.2176	**2.47242
		23			25			23		
	Total	13	5.0769	1.52798	55	1.0541	1.0201	2	5.8125	*10.4847
		8			31			32		
GIRLS	1	52	0.4230	1.4961	23	0.5409	1.0662	0	10.0769	*130.9999
		26			36			13		
	2	38	0.2449	0.5081	35	0.229	1.1456	2	0	0
		13			40			24		
	3	54	0.5333	1.1868	21	1.0428	*3.3651	0	17.4	*90.9276
		30			30			15		
	4	64	0.425	1.1894	11	1.3636	*2.8673	0	0.2175	*79.2775
		50			13			12		
	5	65	0.4553	1.5523	10	1.15	**2.1474	0	13.4	*82.0579
		57			8			10		
	Total	55	2.2534	1.7904	20	3.4071	**2.6704	0	-	*75.5757
		34			28			13		

* = Significant at 0.01 level

** = Significant at 0.05 level

Table No. 44

DIFFERENCES IN THE SCORES OF EACH PROBLEM OF BOYS AND GIRLS FOR THE FIRST AND THE LAST TRAINING SESSION

GROUPS	TASKS	CONCRETE			TRANSITIONAL			FORMAL		
		No.of students	Difference in mean	't' value	No.of students	Difference in mean	't' value	No.of students	Difference in mean	't' value
FIRST TRAINING	1	11	0.1154	0.2968	57	0.3539	0.71556	2	10	*E
		52			23			0		
	2	9	0.1140	0.2203	55	0.0623	0.3158	7	0.3571	0.6332
		38			35			2		
	3	21	0.6667	1.2158	48	0.3761	*3.3853	2	18	*E
		54			21			0		
	4.	29	1.9525	*4.7739	42	0.7922	**2.5929	0	0	0
		64			11			0		
	5	31	0.9533	**2.6329	39	1.2589	*7.6832	1	14	*E
		65			10			0		
	Total	13	4.0951	**2.5935	56	3.9071	*3.8346	2	65	*E
		55			20			0		
LAST TRAINING	1	9	0.6495	0.18941	38	0.0730	0.4117	24	0.0769	1
		26			36			13		
	2	9	0.1965	0.0766	27	0.34	0.4131	35	0.2142	1.4963
		13			40			24		
	3	10	0.5	0.6752	30	0.2	0.6501	31	0.4709	1.1586
		30			30			15		
	4	16	0.45	0.6761	25	0.32	0.6544	28	0.35714	1.4105
		50			13			12		
	5	23	0.6537	1.6443	25	0.31	0.5505	23	0.3826	*0.7807
		57			8			10		
	Total	8	3.2352	1.0164	31	1.5541	1.2072	32	1.8125	1.6970
		34			28			13		

* = Significant at 0.01 level
** = Significant at 0.05 level

E = infinity

Table No. 45

DIFFERENCE IN THE SCORES BOR EACH PROBLEM OF BOYS AND GIRLS FOR THE FIRST AND THE LAST TRAINING SESSION FOR EACH GRADE / AGE

GRADE/ AGE		SEX	I	II	III	IV	V	TOTAL
VII	No.of students	Boys	20	20	20	20	20	20
11+		Girls	18	18	18	18	18	18
	Difference in mean	Boys	0	0.2	0.2	0.5	0.65	0.5
		Girls	0.5555	0.5555	1.0556	1.0004	0.2225	1.1111
	't' value	Boys	0	0.2519	0.3610	0.4650	0.6988	0.1395
		Girls	1.5673	0.6992	1.2257	**2.2153	0.6833	0.6435
VIII	No.of students	Boys	17	17	17	17	17	17
12+		Girls	20	20	20	20	20	20
	Difference in mean	Boys	0.2352	2.0588	2.9411	2	1.4705	11
		Girls	0.65	3.4	4.65	3.45	2.45	14.3
	't' value	Boys	0.7272	**2.7778	**2.7708	**2.5167	1.7966	**2.7224
		Girls	1.3130	*5.3270	*5.2906	*7.6173	*5.6780	*7.8314
IX	No.of students	Boys	17	17	17	17	17	17
13+		Girls	17	17	17	17	17	17
	Difference in mean	Boys	1.2353	2.5882	3	4.4705	2.3527	13.6470
		Girls	2.29412	1.8235	2.5294	3.2941	2.1764	12.2588
	't' value	Boys	*3.4068	*5.0555	*3.5120	*5.7595	*3.4587	*5.8860
		Girls	*4.3167	**2.2519	**2.4702	*3.2778	**2.4304	*3.5838
X	No.of students	Boys	17	17	17	17	17	17
14+		Girls	20	20	20	20	20	20
	Difference in mean	Boys	2.17647	2.2941	4.2941	4.0526	4.7547	16.4705
		Girls	2.3	3.3	4.65	3.3	1.3	15.2
	't' value	Boys	*3.5665	*2.93977	*3.3156	*3.4678	*4.5454	*4.0419
		Girls	*5.9128	*6.7676	*6.0464	*3.4626	1.9156	*6.20809

* - Significant at 0.01 level
** - Significant at 0.05 level

RESULTS:

1. Table No. 43 shows that the 't' value calculated for each problem of the three level of intellectual development out of fifteen 't' values, two were found to be significant at 0.01 level and one was found to be significant at 0.05 level. To be more specific not a single value was found to be significant at the concrete level. For the transitional level out of five 't' value one is significant at 0.01 level. But in the formal stage out of five 't' value one was found to be significant at 0.01 and one was significant at 0.05 level.

2. For the total of all the problems three 't' value was calculated. The value at formal stage was found to be significant at 0.01 level.

3. From Table No. 43, we see that 15 't' values were calculated. In all seven values were found significant. One value was found to be significant at 0.05 level and two was found to be significant at 0.01 level for the transitional stage. For the formal stage one value was found to be significant at 0.01 level and one was significant at 0.05 level. No value was significant for the concrete level.

4. For the total of all the problems three 't' values were calculated. The value for formal stage was found to be highly significant at 0.01 level.

5. From Table No. 44, we find that out of fifteen 't' values calculated for each problem of boys and girls six were found to be significant at 0.01 level, and two were found to be significant at 0.05 level. For the formal stage only a few boys were present at the stage whereas not a single girl was present at the formal stage.

6. From Table No. 44, it is seen that out of fifteen 't' values one was found to be significant at 0,01 level.

7. For the 't' value of the total of all the problems 't' values were calculated, two values were found to be significant at 0.01 level and one at 0.05 level.

8. For the 't' value of the total of the problems not a single value was found to be significant.

9. From Table No.45, for the 't' values of grade VII, age 11+ (boys) not a single one was significant. For grade VIII, age 12+ three values were significant at 0.05 level. For grade IX, X, age 13+ and 14+ all the 't' values were significant at 0.01 level. Hence out of twenty 't' values calculated thirteen were found

to be significant. Here it is seen that as the grade and age increases the difference also increases significantly.

10. For the 't' value of the total for grade VIII the value was significant at 0.05 level and for grade IX and X the values were significant at 0.01 level.

11. From Table No.45, one 't' value was significant for grade VII age 11+ (girls). For grade VIII, age 12+ four 't' values were significant at 0.01 level. For grade IX age 13+ two values were significant at 0.01 level and three at 0.05 level, for grade X age 14+ four values were significant at 0.01 level. Here too as the grade and age increases the difference also increases significantly.

12. For the total 't' value for grade VIII, IX and X were found to be significant at 0.01 level.

HYPOTHESIS No. 4

There is no significant difference between the different mode of presentation of the problem of boys and girls of experimental group for the Post test.

PROCEDURE :

For a single group more than two means were compared and hence analysis of variance test for trends with repeated measures was chosen (Guilfard, 280).

Table No. 46

Difference in the mode of presentation of of the problems

Groups	F ratio	't' significant level	
		0.05	0.01
Boys	** 6.08	3	3
Girls	** 7.43	4	3

Significant at 0.05 level

RESULTS :

From table No. 46, it is seen that when four types of presentation was used to solve the problems during the three

training session, the scores were significantly different. This is seen in both the cases of boys and girls where the values are significant at 0.05 level. Since the F values were significant, separate differences by the 't' test was used for further analysis. It is seen in case of boys, 3 values are significant at 0.05 level and 3 values are significant at 0.01 level. In case of girls, 4 values are significant at 0.05 level and 3 are significant at 0.01 level.

HYPOTHESIS No. 5

There is no significant relationship between intelligence and Pre test, Post test scores of control and experimental group.

(1) There is no significant relationship between intelligence and scores of Pre-test of boys of control group.

(2) There is no significant relationship between intelligence and scores of Post test of boys of control group.

(3) There is no significant relationship between intelligence and scores of Pre test of boys of experimental group.

(4) There is no significant relationship between intelligence and scores of Post test of boys of experimental group.

(5) There is no significant relationship between intelligence and scores of Pre test of girls of control group.

(6) There is no significant relationship between intelligence and scores of Post test of girls of control group.

(7) There is no significant relationship between intelligence and scores of Pre test of girls of experimental group.

(8) There is no significant relationship between intelligence and scores of Post test of girls of experimental group.

Table No. 47

HOPYTHESES RELATED TO THE RELATIONSHIP BETWEEN INTELLIGENCE AND PRE TEST, POST TEST OF CONTROL AND EXPERIMENTAL GROUP

GROUP	PRE TEST ('t' value)	POST TEST ('t' value)
Boys experimental	**-0.3234	**-0.239
Boys control	* 0.1972	0.0592
Girls experimental	**-0.3008	**-0.15218
Girls control	0.0425	0.0124

* = Significant at 0.05 level
** = Significant at 0.01 level

PROCEDURE:

The two variables intelligence and Pre test intelligence and Post test were correlated by means of Pearson's Product moment correlation. The coefficient of correlation significant at the 0.05 and 0.01 level were found out.

RESULT :

Eight correlation were calculated the valued for boys of experimental Group Pre test and Post test were found to be significant at 0.01 level but on the negative side. This shows that the performance at Pre test and Post test are not dependent upon intelligence. Thus, supporting hypotheses No.3 and No.4 for boys control group only one value was found to be significant at 0.01 level. For both the group of girls, the out of four correlation two were found to be significant at 0.01 and 0.05 level on the negative side. This again supports our hypotheses No.5 to 8.

HYPOTHESIS No.6

There is no significant relationship between the personality scores, intelligence scores and Post test scores of those students who are favourably influenced by training. The findings probed under this hypothesis is -

(1) There is no significant relationship between the fourteen personality factors and boys post test scores.

(2) There is no significant relationship between the fourteen personality factors and the post test scores of girls.

(3) There is no significant relationship between intelligence and post test scores of boys.

(4) There is no significant relationship between intelligence and post test scores of girls.

PROCEDURE:

The personality traits were calculated according to H.S.P.Q. Manual. These traits were correlated with the scores of those students who showed improvement in post test, by means of Product Moment Correlation.

RESULTS:

The results are given in Table No.48.

Table No.48

RELATIONSHIP BETWEEN PERSONALITY TRAITS AND SCORES OF PUPILS SHOWING FAVOURABLE INFLUENCE DUE TO TRAINING

SAMPLE	A	B	C	D	E	F	G	H	I	J	O	Q_2	Q_3	Q_4
BOYS	0.1409	- 0.2040	- 0.0701	- 0.1040	- 0.1375	- 0.1715	- 0.0007	- 0.3059*	- 0.0680	- 0.2385**	0.0869	0.0654	- 0.2328**	- 0.0262
GIRLS	- 0.2460	- 0.4672	0.0175	0.2187	- 0.0588	- 0.1332	- 0.1606	0.1679	- 0.1254	0.0338	0.0998	- 0.6799*	- 0.0399	0.1491

* = Significant at 0.01 level
** = Significant at 0.05 level

The table shows that the correlational value for each of the fourteen factors lies between -0.007 to 0.1409 in the case of boys and -0.0399 to 0.2187 in the case of girls. The coefficient of correlation is significant for factors H at 0.01 level and for factor J and factor Q_3 at 0.05 level in the case of boys. All these values are significant on the negative side. The boys who are adventurous, of circumspert individualism and controlled show a tendency to gain from the training. In case of girls the coefficient of correlation is significant at 0.01 level for factor B and Q_2. These values again show a negative trend. Girls who are bright and self-sufficient show favourable sign towards training.

For factor B in case of boys the correlation lies between ±.20 and .± 40 which denotes low correlation, present but slight. Factor A negative side, factor D positive side, again show low correlation in case of girls. Warmhearted and undemonstrative traits also show slight positive correlation to the post test scores.

CORRELATION BETWEEN INTELLIGENCE AND POST-TEST SCORES OF STUDENTS FAVOURABLY INFLUENCED BY TRAINING

Table No. 49

S.No.	Sub-group	Value of r
1.	Girls	- 0.1939
2.	Boys	* 0.3670
3.	Total sample	- 0.18804

* Significant at 0.05 level.

PROCEDURE :

The intelligence score comprised of the raw scores attained by the Raven's progress matrix. Intelligence scores of those students showing favourable effect of training reflected in the Post test scores were taken into consideration. For finding the correlation value Product moment correlation was employed.

RESULTS :

The results obtained are shown in Table No. 49 which shows that out of three correlational value, one was significant at 0.05 level. The other two values are not significant and show a negative correlation. This shows that intelligence does not have any effect on the Post test scores.

DIFFERENCES WITH THE OBTAINED RESULTS IN PRE TEST AND POST TEST AND THOSE WHICH WERE EXPECTED THEORITICALLY ON THE HYPOTHESES

HYPOTHESES :

(1) There is no significant difference between the obtained results in Pre test and Post test scores of experimental group of boys with those expected theoritically.

(2) There is no significant difference between the obtained results in Pre test and Post test of control group of boys with those expected theoritically.

(3) There is no significant difference between the obtained results in Pre test and Post test of experimental group of girls with those expected theoritically.

(4) There is no significant difference between the obtained results in Pre test and Post test of control group of girls with those expected theoritically.

PROCEDURE:

The Chi-Square test was applied for three level of intellectual development and two groups of Pre test and Post test. 3 x 2 group was thus formed.

Table No.50

Value of Chi-Square for three level of intellectual development and Pre test, Post test value for experimental and control group of boys and girls

S.No.	Group compared	X^2	p
1.	Experimental Group Boys Pre test and Post test	13.4136	0.01
2.	Control group boys Pre test and Post test	4.622	Not significant
3.	Experimental group girls Pre test and Post test	11.1856	0.01
4.	Control group girls Pre-test and Post test	19.9498	0.01

RESULTS:

The above table shows that out of four value of Chi-Square only one was not found to be significant. The other three were found to be significant at 0.01 level.

DISCUSSION:

Only the experimental group was subjected to three training session. The control group was, however, given no training. Both the control and the experimental group were given identical Pre test and Post test at an interval of same time. It was found that both the control and the experimental group show an improvement. This was not expected finding theoritically. The control group of boys, however, showed no difference. Hence, to conclude the results obtained in Pre test and post test of boys and girls of both the groups were different from what was expected theoritically.

CHAPTER - VI

ANALYSIS OF MATHEMATICAL STRUCTURES FOR ADOLESCENT THOUGHTS UNDERLYING THE PROBLEMS IN PIAGETIAN CONTEXT AND OTHER VARIABLES

INTRODUCTION :

It is the faith of all sciences that an unlimited number of phenomena can be comprehended in terms of a limited number of concepts of ideal constructs. The constructs in terms of which natural phenomena are comprehended are man made inventions. To discover a scientific law is merely to discover that a man made scheme serves to unify and thereby to simplify comprehension of a certain class of natural phenomena.

In complex area where variables are potentially relevant, a fundamental goal of research is to sort out relationships among the variables in order to obtain clear cut descriptions of the important phenomena.

If abilities are to be postulated as primary causes of individual differences in overt accomplishment, then the widely different achievements of individuals must be demonstrable functions of a limited number of reference abilities. The factor analysis assumes that a variety of phenomena within a domain are related and that they are determined, at least in part, by a relatively small number of functional unities or factors. The name for a factor depends on the contexts, on

one's philosophical preferences and manner of speech and on how much one already knows about the domain to be investigated. Hence, factor analysis is a means for discovering latent structures in a phenomena. It is a very powerful tool for analytical method.

In this study the technique chosen for factor analysis is the Principal Axes Method (PAI). This method is mathematically satisfying because it yields a mathematical unique solutions of a factor problem. Its major solution feature is that it extracts a maximum amount of variance as each factor is calculated.

Some Background Studies :

Vaidya (1964) investigated problem solving among certain group of adolescent pupils in central London, using Hotelling method. Four factors appeared, namely, attainment factor, practical factor, interest factor and adjustment factor.

Lovell and Butterworth (1966) found a 'central intellectual ability' underlying the performance on the tests of proportionality using the Principal Component Analysis.

Dudek et al. (1969) reported an inter task consistancy of Piagetian factor independent of any general intelligence factor entering into the Binet Scale.

Bart (1971) administered four tasks of formal operations, Pendulum task, Conservation of motion on a horizontal plane,

Equilibrium in the Balance and projection of shadows to a group of 90 students of above average scholastic abilities and belonging to three age levels of 13, 16 and 19 years. Also a test of intelligence and the test of formal reasoning of biology, history and literature were given. Factor analysis of these eight measures was done. The eight measures were found to be having bi-factor structure with a large substantial first factor of formal operations and a second factor related to content which distinguished tasks from tests. Formal thought was found to have a substantial verbal intelligence component as well as non-verbal intelligence component.

Stephens et al. (1969) reported significant correlations of W.I.S.C., verbal IQ, performance IQ and a full scale IQ with Piagetian tasks of reasoning and formal operations administered to the subjects of 6 to 18 years of age. They have identified a general intelligence factor when the data were put to factor analysis. The fact that the Piagetian measures were covered by three factors supported the notion of a multidimential structure of intelligence in the Piagetian assessed areas as in the other traditional areas.

Gray, W.M. (1973) studied the factorial structure of concrete and formal operations. His study focussed more on the logical models than the content of problems. 622 pupils ranging from 9 to 14 years in age constituted the sample. Items were presented in several ways open ended and in drawing form.

Results indicated the existence of concrete and formal thought. Even the non-Piagetian type of items provided powerful support to the Piagetian system of thought when it causes to its generalizability.

Weeks (1973) administered three tests : Piaget's test of conservation of volume, Peel's story test to measure logical reasoning and Neimark's test of the understanding of correlation and the ability to use combinatorial analysis, to a sample of 193 seventh graders, 195 eighth graders and 175 ninth graders to measure the development of formal operations. Factor analysis yielded factors that could be reliably classified as either formal operations or verbal reasoning or numerical ability. The loadings of the items indicated a surprising mutual exclusivity of formal operations and verbal reasoning as operationally defined by the tests.

Abramowitz (1975) conducted a study on a group of 32 seventh grade students of 12 - 13 years. A revised version of Karplus's proportionality test organized into test booklets containing six tasks was administered to the subjects in group settings. All the tests that had to do with the handling of fractions were loaded on factor I which accounted for 3.7 per cent of the variance. The average proportionality score and ability were loaded on factor II which accounted for 26.6 per cent of the variance. The size contrast, the ratio contrast and correlative test of universe relations were loaded on

factor 111 which accounted for 19.7 per cent of the variance This depicted the nature of the components of the proportional thought as the skill tests of facility with fractures load on a different factor than tasks involving proportionality.

Guerin (1975) administered Raven's tests of logical operations to 896 students from four to different environments to get the measures of attainment of seven logical operations to associate with the final two stages of Piaget's cognitive development. The structure of the logical operations described above consisted of two correlated factors i.e. the concrete operational factor and the concrete and logical factor. The logical operation of compensation was related to both factors and represented a transition operation between the purely concrete operations and purely formal operations.

Hathway (1976) found that Piagetian measures bare a modest positive degree of relationship to performance on traditional measures of intelligence and thus clarified that the two types of measures were neither totally distinct nor totally identical. Both the measures were found to be contributing to a general intelligence factor. He also found that Piagetian factors were having a dominant concurrent association with the measures of school achievement thus pointed out the way to new and possible more reliable and valid predictors of achievement.

Vaidya (1975) investigating the growth of logical thinking during adolescence using seventeen problems and other tests like, intelligence, adjustment,etc., on a sample of 200 students of grade VI to X found ten factors : Schematic learning, General adjustment, Problem orientation, Sensing problems, Symbolisation, Testing hypotheses using constant differences, Aspect character seeing the problem as a whole, Intelligence.

Sandhu (1980) investigated the structure of formal thought with the help of ten Piagetian type tasks on 986 adolescent pupils studying in grade VI to X. The analysis of the data showed fourteen factors.

Padmini (1982) investigated the growth of exclusion of variables during adolscence on 200 students studying in grade VI to X, stating and testing of hypotheses, Intelligence,HSPQ and Aptitude tests etc. were administered and twelve factors were obtained.

The Present Study :

The major objectives of this study was to make a comprehensive study of the mathematical structure for adolescent thoughts underlying the problems of Piagetian context and also tasking the measures of other variables such as intelligence and personality traits. To test this hypothesis, the data regarding all the 20 variables were put to factor analyses

using Principal Axes Method. The sample constituted of 80 subjects - 40 girls and 40 boys of the experimental group after the Post-test, from grades IX and X. The selection was based on the criteria of favourable influence of training. List of these twenty variables, their name and abbreviations are mentioned in appendices.

Hypothesis :

There does not exist any strong factorial structure underlying the measures of intelligence, personality traits and scheme of thoughts for the five Piagetian type tasks.

Correlation Matrix :

A correlation matrix (20 x 20) is presented in the table for the measures of 20 variables for the sample of 80 students selected for the study, as already mentioned above, considering the half correlation matrix divided symmetrically by the oleagonal it was found to consist of 189 correlations coefficients. There were 108 positive and the 81 remaining were negative coefficient of correlation. Out of 108 positive coefficient of correlation 14 were significant at .01 level and 7 at .05 level. Out of 81 negative coefficient of correlation 12 were significant at .01 level and 7 at .05 level. The magnitude of the coefficients of correlation irrespective of the signs were found ranging from 1.000 to .001.

Table No 51

Correlation Matrix (Gen - [illegible] sample - [illegible])

Var	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
2		137	352*	137	233*	074	[illegible]	[illegible]	[illegible]	[illegible]	156	[illegible]	[illegible]	111	166	[illegible]	134	[illegible]	[illegible]	[illegible]
3			045	215	002	264**	267**	225	117*	143	056	136	021	038	076	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4				224	190	227*	037	[illegible]	121	165	086	[illegible]	305*	263**	118	[illegible]	[illegible]	[illegible]	[illegible]	133
5					293**	073	063	251**	423*	131	177	151	265**	227	491*	327	[illegible]	[illegible]	[illegible]	[illegible]
6						052	069	303*	345*	084	113	168	211	372*	582**	011	[illegible]	[illegible]	[illegible]	[illegible]
7							169	122	122	133	031	216	007	274**	129	143	161	152	118	028
8								101	112	172	245**	156	037	089	057	016	053	129	086	030
9									211	047	009	363*	349*	533**	422*	085	098	159	163	072
10										050	068	237**	109	080	447*	074	006	065	231	085
11											045	035	027	092	045	102	068	189	128	025
12												204	014	121	142	073	044	150	022	103
13													036	354*	145	231	167	193	3	143
14														293**	327*	059	044	043	129	050
15															319*	259**	290**	210	204	028
16																066	054	030	017	175
17																	737*	763*	620*	212
18																		838*	658*	303*
19																			696*	310*
20																				155
21																				

N.B. : All the values are given without their decimals

* = Significant at .01 level

** = Significant at .05 level

Obtaining the Factors:

The correlation matrix of (20 x 20) discussed above was subjected to factor analysis using the Principal Axes Method. Six significant factors were obtained which were having eigen value greater than one. These six factors were retained for varimax rotation. The factor loading of the 20 variables for each of the six significant factors are presented in the case of original factors as well as varimax rotated factors in Table No.1 and Table No.2 respectively. It is evident from the results presented in Table No.3 in case of original factors, the cumulative percentage of eigen values accounted for the factors one to six have been found to be ranging from 18.8% to 65.9%.

Factoring of Correlation Matrix:

Mathematical statisticians use diagonal and centroid method of factoring correlation matrix to obtain estimates of common factor; communalities and factor loadings. This method involves in inclusions of different values in the Principal Diagonals of correlation matrices. Most commonly inserted are the commonality values, the reliability coefficients and the unity (1.0) which represents self-correlation of a Test Score. At least three tests are hypothesised to get the common factor which account for all the sets of tests. Eigen values then confirm the exact number of the common factors obtained in the set. The sign value which is one for exceed

TABLE NO 52

PRINCIPAL FACTOR MATRIX

VARIABLES	FACTOR I	FACTOR II	FACTOR III	FACTOR IV	FACTOR V	FACTOR VI
VAR 002	-0.062	0.290	-0.643	0.070	-0.458	0.036
VAR 003	-0.050	0.270	-0.087	-0.665	-0.172	-0.288
VAR 004	-0.195	0.236	-0.658	-0.022	0.308	0.249
VAR 005	-0.257	0.630	0.034	-0.196	0.002	0.275
VAR 006	0.360	-0.606	0.063	-0.283	0.243	-0.154
VAR 007	0.299	-0.001	-0.389	-0.541	0.169	0.088
VAR 008	-0.133	0.032	0.055	-0.660	0.233	0.028
VAR 009	-0.518	0.453	-0.025	0.011	0.184	-0.498
VAR 010	-0.355	0.409	0.255	-0.293	-0.591	0.063
VAR 011	-0.096	-0.138	-0.365	-0.379	0.063	-0.273
VAR 012	0.206	-0.120	-0.260	0.250	-0.320	-0.619
VAR 013	0.473	-0.152	-0.482	0.128	-0.124	0.250
VAR 014	0.210	-0.383	0.387	-0.192	-0.455	0.115
VAR 015	-0.610	0.303	0.028	0.336	-0.307	-0.148
VAR 016	0.371	-0.706	-0.032	-0.057	0.105	-0.114
VAR 017	-0.719	-0.469	-0.027	0.010	-0.007	0.134
VAR 018	-0.728	-0.537	-0.037	0.033	-0.046	0.031
VAR 019	-0.775	-0.507	-0.109	-0.077	-0.012	0.076
VAR 020	-0.702	-0.380	0.025	-0.149	-0.199	0.006
VAR 021	-0.193	-0.345	-0.491	0.110	-0.290	0.010

TABLE NO 53
VARIMAX ROTATED FACTOR MATRIX

Variables	Name of variables	Factor I	Factor II	Factor III	Factor IV	Factor V	Factor VI
VAR 002	Intelligence	-0.018	0.414	0.655	0.118	0.089	0.307
VAR 003	Personality factor A	-0.080	0.304	-0.097	-0.068	0.713	0.128
VAR 004	Personality factor B	0.060	0.061	0.516	0.565	0.179	-0.244
VAR 005	Personality factor C	-0.115	0.615	-0.022	0.215	0.128	-0.351
VAR 006	Personality factor D	0.010	-0.704	-0.107	-0.288	0.266	-0.006
VAR 007	Personality factor E	-0.208	-0.195	0.314	-0.015	0.591	-0.199
VAR 008	Personality factor F	0.089	0.014	-0.192	-0.005	0.599	-0.329
VAR 009	Personality factor G	0.117	0.358	-0.364	0.616	0.180	0.263
Var 010	Personality factor H	0.123	0.809	-0.145	-0.286	0.153	0.037
VAR 011	Personality factor I	0.168	-0.140	0.124	0.123	0.524	0.174
VAR 012	Personality factor J	-0.105	-0.139	0.115	-0.007	-0.013	0.793
VAR 013	Personality factor O	-0.243	-0.254	0.652	-0.137	-0.070	0.025
VAR 014	Personality factor Q_2	0.078	-0.048	-0.105	-0.760	-0.027	0.027
VAR 015	Personality factor Q_3	0.272	0.257	-0.268	0.656	-0.225	0.005
VAR 016	Personality factor Q_4	0.074	-0.729	0.059	-0.328	-0.059	0.114
VAR 017	Piagetian task-I Wax Problem	0.861	-0.019	-0.016	0.045	- 0.060	-0.093
VAR 018	Piagetian task-II Bending of Rod	0.892	-0.113	-0.061	0.089	-0.049	-0.021
VAR 019	Piagetian task-III Ramp Problem	0.932	-0.031	0.011	0.068	0.055	-0.049
VAR 020	Piagetian task-IV Flow of liquid through a tube	0.811	0.136	-0.082	-0.084	0.094	0.039
VAR 021	Piagetian task-V Simple pendulum	0.410	-0.067	0.493	-0.028	0.003	0.277

Table No 54

Showing six factors having Eigen values greater than unity

Factor	Eigen value	Percentage of variance	Cumulative percentage
1.	3.754	18.8	18.8
2.	3.174	15.9	34.6
3.	1.923	9.6	44.3
4.	1.798	9.0	53.3
5.	1.423	7.1	60.4
6.	1.102	5.5	65.9

unity provide the common factors. Computer facilities are used to obtain such factors. Table No.3 shows six common factors thus extracted along with their eigen values.

Significance of Factors :

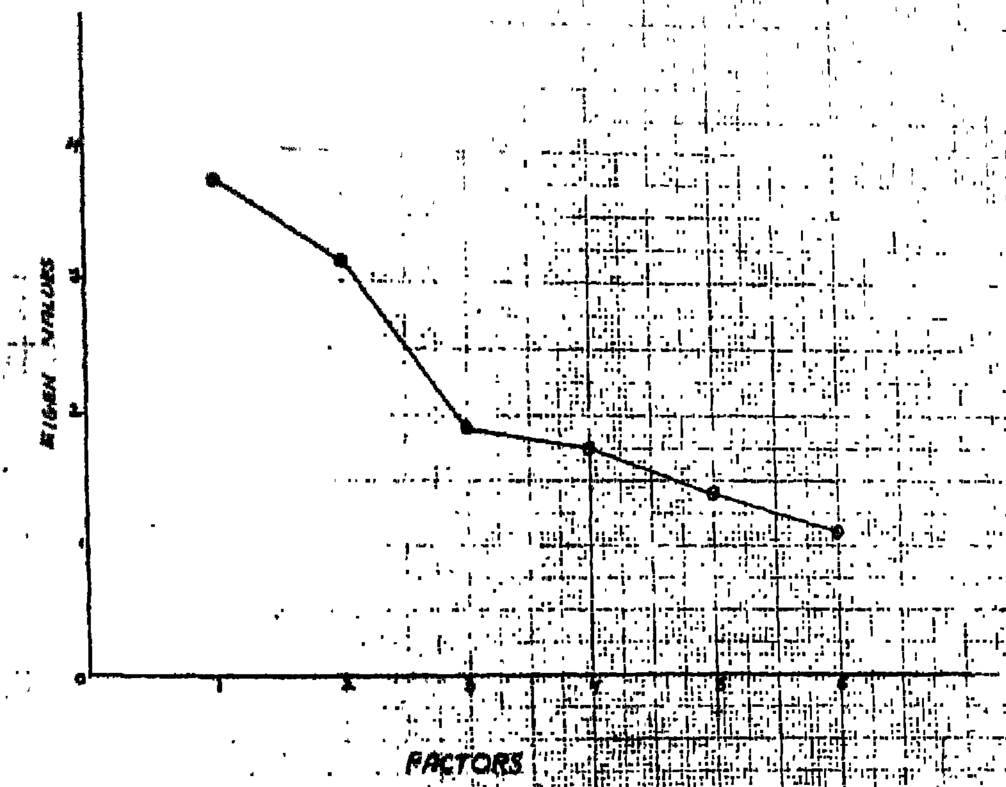
To simply the interpretation of factors and to draw attention to only those factors loadings which contributed significantly for determining the nature of the factor, smaller factor loadings were ignored. However, there is no definite criteria for judging how small a factor loading should be, to be called small enough to be ignored. Benjamin Fruchter (1967) has suggested that values of factor loadings less than .20 are generally speaking insignificant and hence can be ignored, whereas various other research workers have ignored values upto .300 (Vaidya, 1975). In the present study the loadings of the different variables on the various factors having values numerically less than .35 (Jain, M., 1984 and David, R.E., 1987) have been ignored while interpreting the factors.

Eliminaton of Factors Using Scree Test:

When the six factors are subjected to Scree Test as propounded by Cattell & Vaidya, 1975 two factors from bottom upwards are found to have eigen values of approximately equal magnitude. Figure 1 shows the points of all the six eigen values meaning that out of the six factors four of distinct values were retained.

FACTOR ANALYSIS GRAPHIC RELATIONSHIP BETWEEN THE SIX FACTORS AND THEIR EIGEN VALUES.

(SCREE TEST)



Inpterprotation of Factors and Discussions :

The four factors of distinct eigen values have been retained for interpreting psychologically.

Factor I :

Significant loadings of the different variables on factor I for original as well as varimax rotated have been shown in the Table below. The ten variables that have significant factor loadings on factor I inthe original are for personality factors D, G, H, O, Q_3, Q_4, the wax problem, flow of liquid through a tube problem - all these problems being based on separation and controlling of variables scheme of thought. Out of these seven have negative value.

Varimax rotated factor I in the Table shows significant loadings on five variables of schemes of thought. All have positive values. The factor I has, therefore, been named as separation of variable which has the highest significant loading 0.932.

TABLE NO 65

Original Factor I

Significant loadings

S. No.	No. of variables	Name of variables	Loadings
1.	6	Personality factor D	0.360
2.	9	Personality factor G	- 0.518
3.	10	Personality factor H	- 0.355
4.	13	Personality factor O	0.473
5.	15	Personality factor Q_3	- 0.610
6.	16	Personality factor Q_4	0.371
7.	17	Piagetian Task I	- 0.719
8.	18	Piagetian Task II	- 0.727
9.	19	Piagetian Task III	- 0.774
10.	20	Piagetian Task IV	- 0.702

TABLE NO 66

Varimax Rotated Factor I

Significant Loadings

S. No.	No. of variable	Name of variables	Loadings
1.	17	Piagetian Task I	0.861
2.	18	Piagetian Task II	0.892
3.	19	Piagetian Task III	0.932
4.	20	Piagetian Task IV	0.811
5.	21	Piagetian Task V	0.410

Factor II

As shown in the table, there are 10 significant loadings. Out of which seven loadings have negative values. The variables showing the significant loadings are for Personality factor C, D, G, H, Q_2, Q_4, Piagetian Task I, II, III and IV.

Varimax rotated factor II loadings which are significant are shown in the Table. Six loadings are significant. Out of which two are of negative value. These loadings are for variables, intelligence, personality factor C, D, G, H, Q_4. The highest loading is seen in personality factor H which is 0.809. Hence, this factor can be named as Personality factor H, i.e., Adventurous.

TABLE NO 57
Original Factor II
Significant Loadings

S. No.	Name of variable	Loadings
1.	Personality Factor C	0.630
2.	Personality Factor D	- 0.603
3.	Personality Factor G	0.453
4.	Personality Factor H	0.408
5.	Personality Factor Q_2	- 0.383
6.	Personality Factor Q_4	- 0.706
7.	Piagetian Task I	- 0.469

Contd....

S. No.	Name of variables	Loadings
8.	Piagetian Task II	- 0.537
9.	Piagetian Task III	- 0.506
10.	Piagetian Task IV	- 0.380

TABLE NO 58

Varimax Rotated Factor II

Significant Loadings

S.No.	Name of variables	Loadinngs
1.	Intelligence	0.414
2.	Personality Factor C	0.615
3.	Personality Factor D	- 0.704
4.	Personality Factor G	0.358
5.	Personality Factor H	0.809
6.	Personality Factor Q_4	- 0.729

Factor III

Significant loadings for factor III as seen in the Table reflect seven significant loadings for variables of intelligence, personality factor B, E, I, O, Q_2 and Piagetian task V. Out of these seven significant loadings, six have negative values.

From the varimax rotated factor III table five significant loadings have been observed. Only one loading was found to have negative value. The variables showing significant loadings are intelligence, personality factors B, G, O, and Piagetian task V. On seeing both the tables, the highest loading was found for variable - intelligence 0.655. Hence, this factor can be named as Intelligence factor.

TABLE NO 59

Original Factor III

Significant Loadings

S.No.	Name of variables	Loading
1.	Intelligence	- 0.643
2.	Personality factor B	- 0.658
3.	Personality factor F	- 0.389
4.	Personality factor I	- 0.365
5.	Personality factor O	- 0.482
6.	Personality factor Q_2	0.387
7.	Piagetian Task V	- 0.491

TABLE NO 60

Varimax Rotated Factor III

Significant Loadings

S.No.	Name of variables	Loadings
1.	Intelligence	0.655
2.	Personality factor B	0.516
3.	Personality factor G	- 0.364
4.	Personality factor O	0.652
5.	Piagetian task V	0.493

Factor IV

For the original factor IV four negative significant factor loadings for variables personality factors A, E, F and I.

For the varimax rotated factor IV, four significant loadings could be located, out of which only one showed negative loading. The variable having these significant loading are personality factors B, G, Q_2 and Q_3. The highest factor loading is for variable personality factor Q_2 which is - 0.760 . Hence this factor has been named Personality factor (Q_2) i.e. self-sufficient. This factor is of bipolar nature.

TABLE NO 61

Original Factor IV

Significant Loadings

S.No.	Name of variables	Loadings
1.	Personality factor A	- 0.665
2.	Personality factor E	- 0.541
3.	Personality factor F	- 0.660
4.	Personality factor I	- 0.379

TABLE NO 62

Varimax Rotated Factor IV

Significant Loadings

S.No.	Name of variables	Loadings
1.	Personality factor B	0.565
2.	Personality factor G	0.616
3.	Personality factor Q_2	- 0.760
4.	Personality factor Q_3	0.656

Results :

The analysis of mathematical structure for 20 variables show that there are strong factorial structures underlying personality factors, intelligence and scheme of thought resulting in six significant factors. Though Scree tests

it was found that out of the four factors had different magnitude and two factors could be eliminated as they had almost equal magnitude. The four factors with their name eigen values and cumulative percentage of eigen values are shown in the Table.

TABLE NO 63

Psychological Nomenclature of Factors

S.No.	Order of factor	Psychological Nomenclature
1.	First	Separation of variables
2.	Second	Personality factor H - Adventurous (Bold)
3.	Third	Intelligence - Abstract thinking
4.	Fourth	Personality factor Q_2 - Self-sufficient (prefers own decisions)

The Current Picture of the Structure for Piagetian Thought :

The current picture of the structure for adolescent thought are summarised in the table given below. It is very much difficult and logically not appropriate to compare the findings of various studies which have attempted to analyse the mathematical structures of adolescent thoughts. The reason

being that the findings come from different samples using different tests and techniques. Even then for the sake of clarity, the different factors that emerge are as follow:

TABLE NO 64

Table showing the factorial structure of the Adolescent thoughts

S. No.	Factors	Psychological interpretations	References
1	2	3	4
1.	First Factor	1. General Intellectual factor	Peal (1955), Beard (1957), Hatab (1964), Mac Arthur (1968), De Lemas (1969), Tuddenham (1970), Vernon (1971), Staver and Gabel (1979), Sandhu (1980), Kezekia (1985).
		2. Schematic Learning General	Bart (1971), Lawson and Renner (1975), Vaidya (1975), Jain (1982).
		3. Attainment Factor	Vaidya (1964), S.Mehndiratta (1987), Sharma Veena (1987).
		4. Algebraic Aptitude	Joshi (1970)
		5. Concept of Perspective	De Avila (1973), Garcia et al. (1975)
		6. Formal Operational thought	Abramowitz (1975)

Contd....

1	2	3	4
		7. Concept of relations	Garfinkle (1975)
		8. General adjustment	Vaidya and Mishra (1975)
		9. Exclusion of variables	Shayer (1978)
		10. Language Factor	Padmini (1982)
		11. Separation of variables	*
2.	Second Factor	1. Practical Factor	Vaidya (1964)
		2. Symbolic substitution	Joshi (1970)
		3. Factor of Operational thought	Hathway and Hathway (1974)
		4. Adjustment	Vaidya (1975)
		5. Seeing the Problem as a whole	Vaidya & Mishra (1975)
		6. Piagetian Cognitive Development	Staver and Gabel (1979)
		7. Some and all and sorting	S.S. Pandey (1979)
		8. Academic Achievement Factor	Sandhu (1980), Vaidya and Sandhu (1981)
		9. Exclusion of variables (Testing of Hypotheses)	Padmini (1982)

Contd.....

1	2	3	4
		10. Creative Thinking	Jain (1982)
		11. Grasping the essence of the problem	Kezekia (1985), David, R.E. (1987)
		12. Abstract thinking (Piagetian)	Agarwal, V.P. (1987)
		13. Personality factor forth right/shrewd	David, R.E. (1987)
		14. Group personality factor Adventurous	*
3.	Third Factor	1. Interest Factor	Vaidya (1964)
		2. Problem Orientation	Vaidya (1975)
		3. Formulating Hypotheses	Vaidya & Mishra (1975)
		4. Concept of logic	Garfinkla (1975)
		5. Piagetian Logical Operation Test	Staver and Gabel (1979)
		6. Adjustment Factor	Sandhu (1980)
		7. Exclusion of variables (Stating of Hypotheses)	Padmini (1982)
		8. Academic Achievement	Jain (1982)
		9. Generalised Logical Thought	Kezekia (1984)
		10. Super Ego Strength	Manju Jain (1984)

Contd....

1	2	3	4
		11. Grasping the essence of the problem	David,R.E. (1987)
		12. Social intelligence	*
4.	Fourth Factor	1. Adjustment Factor	Vaidya (1964)
		2. Seeing the Problem	Vaidya (1975)
		3. Interest and Generaling Difficult Problems	Vaidya & Mishra (1975)
		4. Behavioural Factor	Sandhu (1980)
		5. Super Ego Strength	Padmini (1982)
		6. Probabilistic Reasoning	Jain (1982)
		7. Language Ability	Sharma, Veena (1987)
		8. Self-sufficient	*
5.	Fifth Factor	1. Problem Orientation	Vaidya (1975)
		2. Newness of the Problem	Vaidya & Mishra (1975)
		3. Emotional Factor	Sandhu (1980)
		4. Group Factor of Personality (Dominance, Guilt and Ergic Tension)	Padmini (1982)
		5. Proportional Reasoning	Jain (1982)

Contd....

1	2	3	4
6.	Sixth Factor	1. Testing Hypotheses	Vaidya (1975)
		2. Using Constant Differences	Vaidya (1975), Manju Jain (1984)
		3. Temperamental Factor	Sandhu (1980)
		4. Formulation and Combinations	Padmini (1982)
		5. Piagetian Cognitive Development	*
7.	Seventh Factor	1. Aspect Character	Vaidya (1975)
		2. Group Factor of Adolescent Thought-I	Sandhu (1980)
		3. Mechanical Reasoning	Padmini (1982)
8.	Eighth Factor	1. Exclusion of variables	Vaidya (1975)
		2. Social Factor	Sandhu (1980)
		3. Self-Sufficiency	Padmini (1982)
9.	Nineth Factor	1. Combinational Grouping	Vaidya (1975)
		2. Seeing the Problem as a whole	Vaidya (1975)
		3. Group Factor of Personality I	Sandhu (1980)
		4. Age	Padmini (1982)

Contd...

1	2	3	4
10.	Tenth Factor	1. Intelligence	Vaidya (1975)
		2. Verbal Description Procedure Surgency	Vaidya (1975), Vaidya & Sandhu (1981)
		3. Abstract Thinking Factor	Sandhu (1980)
		4. Parmia	Padmini (1982)
11.	Eleventh Factor	1. Group Factor of Adolescent Thought-II	Sandhu (1980)
		2.* Excitability	Vaidya & Sandhu (1981)
		3. Ego Strength	Padmini (1982)
12.	Twelfth Factor	1. Stating and Testing Hypotheses	Sandhu (1980)
		2. Intelligence	Padmini (1982)
13.	Thirteenth Factor	1. Group Factor of Personality II	Sandhu (1980)
14.	Fourteenth Factor	1. Group Factor of Adolescent Thought II	Sandhu (1980)

* Factors found out in the present study.

The present study has some similar results with other studies, while it differs in many areas because the small group sample studies using limited tests have not yielded the

same factors. Secondly, there has been a little uniformity in the choice of tasks, the reasoning patterns and other variables for facilitating comparison of findings.

***

CHAPTER - VII

THE EFFECT OF TRAINING ON CONTROLLED EXPERIMENTATION DURING ADOLESCENCE

(SUMMARY)

INTRODUCTION :

Piaget's idea of education lays importance on experience involving direct action upon objects - a necessary precursor to concept formation and learning. Activity brings about the growth of cognitive structures. Such experience may accelerate or delay mental development but will not alter its essential character which proceeds in stages in every individual i.e., mental mechanisms becomes functional only with the maturation of the organism. The acquisition of new cognitive structure will depend on how a new experience is matched to the already available structure. We are then faced with one problem that if activity and cognitive structure are so linked then can learning be accelerated by training the children to acquire concepts.

PAST WORK :

In the light of the above stated question, work on training and its effect on learning is being done for the last decade. The results of these studies are of a conflicting nature. Chronologically studies showing a positive influence are Banks (1958), Neal (1961), Lunzer (1969), Simcex (1970), Brainerd (1971), Shavelson (1971), Wason and Shaprio (1971), Quinn (1972), Case and Fry (1973), Renner and

Lawson (1973), Gutchfield (1974), Inhelder, Sinclair and Bovet (1974), Berzonsky (1975), Linn & Thier (1975), Arons (1976), Kuhn (1976), Howe (1977), Peterson (1977), Wollman (1977), Linn & Levine (1978), Bawa (1981), Riesz (1981), Sneider (1982), Campbell (1983). The studies which show that training does not accelerate learning is seen in the works of Anfin (1976), Linn, Chen and Thier (1977), Stone and Day (1978), Wyatt (1982). There are still some with a third view that training is neutral with regards to accelerating learning viz., Ri noldi (1962), Dyrli (1967), Bradley (1972), Breddemman (1975), Brainerd (1974), Lawson, Blake and Norland (1975), Wheeler and Kass (1977).

KEY STATEMENTS FROM THE STUDIES :

- If thinking is regarded as a mental skill based upon innate capacity, then training, experience and practice influence thinking.

- Use of formal reasoning dependents on age, intelligence and grade.

- Pupil's learning is facilitated and their knowledge is retained if they have some related prior concepts.

- Training properly designed is helpful over a wide range of age.

- Certain aspects of teaching learning in science are helpful in the emergence of formal thought among those who are about in the last phase of concrete development.
- Highly verbalised procedures even influence acquisition of Piagetian concepts.
- The modes of presenting the problem influence their problem solving behaviour.
- Sex differences in the problem solving behaviour were noticed.
- Use of concrete materials is more effective than verbal procedures.
- Instruction promotes training.

Thus, the studies reviewed do not efield a clear conclusion. It is not possible to answer the question whether accelerated learning can result through training. Therefore, the problem is open for investigation.

DISTINGUISHING FEATURE OF THE STUDY:

The present study attempts to find out the effect of training in a wider frame of reference. It is different from the above mentioned studies in many respects such as -

- It uses matched groups (age, grade, intelligence and socio-economic status).

- It selects both adolescent boys and girls over a wider age range.

- It classifies individual adolescent pupils at the three level of intellectual development, namely, concrete, transitional and formal.

- It studies the influence of training at each of the above mentioned levels of intellectual development both within the age group and across the age groups as well.

- It attempts to determine the personality characteristics of pupils who are favourably influenced by training.

- It attempts to determine the difference in mathematical structures of tasks used through factor analysis.

AIMS AND OBJECTIVES:

The major purpose of the study is to find out the role of training on controlled experimentation and its relationship to accelerated learning. More specifically speaking the objectives are -

- To determine the status of thought at the three levels of intellectual development viz., concrete, transitional and formal, using a suitable test among certain group

of adolescent pupils matched on intellegence, age, grade and socio-economic status.

- To determine the effect of training on the three levels of intellectual development.

- To determine the relationship between the various personality traits and the three levels of intellectual development.

- To determine the personality characteristics of three pupils who are favourably influenced by training.

- To determine the influence of training, sex-wise, age wise and grade wise.

- To determine the effect of different modes of presentations of the problem.

- To determine the difference in mathematical structure of thought and personality traits in respect of experimental group through factor analysis.

- To point out main educational implications, if any.

HYPOTHESES :

To achieve the above mentioned aims of the study the following Null Hypotheses were framed :

(1) There is no significant differences between the scores of Pre-test and Post-test for control and experimental

group at the three levels of intellectual development sex wise, grade wise and age wise.

(2) There is no significant difference in scores during the three training sessions.

(3) There is no significant difference in the mode of presentation of the problems.

(4) There is no significant relationship between intelligence, personality factors and post test performance of control and experimental group.

(5) There is no significant relationship between the personality scores and post test scores for those students who are favourably influenced by training.

(6) There is no strong factorial or mathematical structures underlying the measures of intelligence, personality traits and various scheme of thought of those students showing favourable influence of training.

THE SAMPLE :

The total sample of three hundred and twenty students was split up into two main sub-groups viz., the control and the experimental group. Each sub-group had about one hundred and sixty students. Each sub-group was again divided into two groups of boys and girls, drawn from grades seven to ten, twenty boys and twenty girls from each grade. Thus, there

were four grades each for boys and girls of control and experimental groups. The age range was from 11^+ to 14^+ years. The entire sample was matched against age, socio-economic status and intelligence. The sample consisted of local schools of Udaipur city.

METHODOLOGY :

The nature of the study being controlled experimentation, matched group - age wise, intelligence wise and socio-economic status wise through grade and sex was selected. This was done in order to avoid the effect of extraneous variables on dependent variable. To prepare the matched group,the following tests were used :

(i) Raven's progressive matrices to determine the intellectual level of the pupils.

(ii) Socio-economic status questionnaire prepared by the investigator.

Besides these tests H.S.P.Q. prepared by Cattell was used to measure personality traits.

The main investigation was split up into three stages.

Stage I :

A battery of four stimulating problems. This was administered simultaneously on control and the experimental group. These four problems consisted of Piaget type tests. The first three were based on the combinatorial scheme of

thoughts, viz., the digital problem, beaker problem, magic-seed problem. The last test was based on the exclusion of variable scheme of thought. The stimulating problems were followed by the fine tests of Pre-test. These were the wax problem, bending of rod problem, ramp problem, flow of liquid through a tube and the simple pendulum problem. These were based on two schemes of thought, controlling and separation of variables and exlusion of variables.

Stage II :

The pre-test was followed by three training sessions imparted only to the experimental group at an interval of two weeks apart. The problems selected for the training sessions were the same Piagetian type test as of the Pre-test. The presentation varied from verbal, demonstration, pictorial to experimentation.

Stage III :

Immediately after the third training session Post test was conducted on both the control and the experimental group. The Post-test consisted of the same fine Piagetian type tests as the Pre-test..

SCORING PROCEDURES :

For the Raven's progressive matrices the scoring was done according to the mannual. Each right answer carried one mark. For the high school personality Questionnaire, the

raw scores were obtained with the help of the scoring key. These raw scores were converted into sten scores in accordance with the manual. The socio-economic status questionnaire had three main categories - education, occupation and income. Each category had a maximum of 6 marks.

For the Pre-test, three training sessions and the Post test problems the scores were awarded on the basis of the students ability to exhibit the appropriate behaviour, i.e., either to separate and control the variables or to exclude the irrelevant variables. Task responces were categorized and scores were awarded on a four point scale.

MAIN FINDINGS :

- There is no significant difference between the pre-test scores of control and experimental group for different grades, age and sex.
- There is a significant difference between the Pre-test and Post-test scores of control and experimental group for the three levels of intellectual development grade wise, age wise, and sex wise.
- There is a significant difference in the mode of presentation of the problems.
- There is a significant difference in the scores of the first and the last training session, sex wise,

grade wise, age wise for the three levels of intellectual development.

- There is significant relationship between personality factors and post test scores of those students who are favourably influenced by training.

- There is no significant relationship between intelligence and Post test scores of those students who show a favourable influence of training, grade wise and age wise (sex wise the relationship varied).

- There is strong factorial structures underlying personality traits, intelligence and scheme of thought for those students who were favourably influenced by training. The four factors being -
  (i) Separation of variable scheme of thought
  (ii) Adventurous
  (iii) Intelligence
  (iv) Self sufficient i.e., prefering own decisions, is resourceful.

CONCLUSIONS :

The present study reveals that learning may occur provided that the training treatment incorporates laws of spontaneous development and the subjects already possess some understanding of the concepts to be trained; that the mode of presentation of the problems did effect the progress of thought. The greater the variety of presentation and practice,

the better stabilized a structure becomes. It also supports the view that though training helps to accelerate schemes of thought acquisition, yet it follow the sequence put forward by Piaget. With the exception of few cases of ninth and tenth grades, too rapid a change could not be warranted for. The improvement which marked the accelerated learning consisted of general advances on several dependent variables. The subject gave correct answers on the repetition of the Pre-test for that scheme of thought after training. The inducement of acceleration is evident from the significantly greater number of variables controlled in the Post-test as compared with the Pre-test as well as the responses from the first training session to the last one, more pronounced from concrete to transitional operations rather than from transitional to formal operations. Many of the student went from very low scores to perfect scores.

EDUCATIONAL IMPLICATIONS :

The educational implications arising out of the study are as follows :

- Children should be allowed abundently the processes rather than the products of thought.
- Children need training in handling their irradic ideas. This is only possible through experimentation. It is through action as well as thinking through actions that the real knowledge is born in the minds of individual children.

- The children should be encouraged to develop a scientific outlook, be able to discover scientific law.
- The children should be given exercises in logical meaningful thinking of the learning task which initiates meaningful learning.
- The effectiveness of the training is mutually dependent upon the intellectual developmental level of the child, the type of problem and the kind of training techniques used. This provides a basis for the construction of the curriculum.
- For successful teaching, methods, the plan and the procedures play an important role. Training with concrete material builds up a lively, interesting and activity based atmosphere which promotes learning and helps the teaching strategies.
- Through training procedures creative capacities are encouraged.
- Training procedure gives each individual an opportunity to progress according to his mental capacity.
- Through training learning can be made more effective by integrating the new structures formed and the already existing structures.

- By promoting activity in the classroom, the teacher can explore the child's potential for learning and permit him to evolve an understanding of the world around him.

- Through training the performance is so much faster on a mental level than on an overt level that the child is able to do more in a given period of time.

- The training procedures are in accordance to the laws of spontaneous learning that is from simple to complex and from concrete to abstract. This helps not only in meaningful learning but also in transfer of learning.

AREAS FOR FURTHER RESEARCH :

The method and results pose new problems which can be investigated. They can be briefly stated as follows to accelerate the developmental and psychometric aspects of intelligence. In the study only two schemes of thoughts have been dealt with. Other schemes are thus open for investigation. Training is successful if it can be transferred to familiar and unfamiliar situations. This can be explored. Retention is another area which can be probed into to find out the lasting effect of training. There is also a need to compare the illitrate non school going children with school going children to assess the importance of schools

in intellectual development. Comparison could also be made between different modes of presentation for different Piagetian Tpe Tasks. To find out separate training procedures which can be effective to teach different levels of concepts or schemes of thoughts. To find out the reasons for failure in problem solving and to investigate the possibility of the existence of hump effect. To give treatment of factor analysis to those factors, which had not appeared prominently in adolescent thought. It can also be worthwhile to know whether or not greater operativity is achieved by virtue of training when there is no vestige of the greater operativity. Will training in one concept effect the growth on another concept which occurs near in line ? What will be the effect of relatively short training period on a long term intellectual growth ?

BIBLIOGRAPHY

BOOKS

Athey, I.J. and Rubadean, D.O. : Educational Implications of Piagets' Theory, Ginn-Blaisdell, London etc. 170.

Almy, M. : Young Children's Thinking. Teachers College Press, Columbia University, New York, 1966.

Ausubel, D.P. : The Psychology of Meaningful Verbal Learning: An Introduction to School Learning, Grune and Stratton, New York, 1963.

Ausubel, D.P. : A cognitive-structure Theory of School Learning: In L. SIEGEL (Ed), Instruction : Some Contemporary Viewpoints, San Francisco:Chandler, 1967.

Ausubel, D. and Robinson, F.: School Learning : An Introduction to Educational Psychology, Holt, Rinehart and Winston, New York, 1969.

Bartlett, F.: Thinking, An Experimental Study, George Allen and Unwin Ltd., London, 1958.

Beard Ruth M.: 'An Outline of Piaget's Developmental Psychology' Routledge and Kegan Paul, London, 1969.

Berlyne, D.E. : Structure and Direction in Thinking, Wiley, London, 1965.

Bevli, Updesh K. : Concept Formation in Children Eco-cultural Context, National Publishing House, New Delhi, 1982.

Brainerd, C.J.: Piaget's Theory of Intelligence. Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1978.

Brown, G. and Desforges,C.: Piaget's Theory : A Psychological Critique. Rouhledge & Kegan Paul, London, Boston & Henley, 1979.

Bruner, J.S., Goodnow, J. and Austin, G.A.: Study of Thinking. Wiley, New York, 1956.

Bruner, J.S.: Toward a Theory of Instruction. Harvard University Press, Cambridge, 1966.

Bruner, J.S.: The Relevance of Education. Norton, New York, 1971.

Craig, R.C., Mehrens, W.H. and Clarizio, H.E.: Contemporary Educational Psychology: Concepts, Issues, Applications. Wiley, New York, 1975.

Crutchfield, M.A.: Conservation Training and School Readiness. 'Piagetian Theory and Helping Professions (Ed) Lubin, G.I., Magary, J.F. and Poulsen, M.K. Publication Department, University of Southern California, Los Angeles, California, 1975.

Davis, Frederick, B.: Item Analysis Data, Their Computation, and use in Test Construction. Graduate School of Education, Harvard University, Cambridge, Massachusetts.

Dececco, J.P. and Crawford, W.: The Psychology of Learning and Instruction. Educational Psychology, Prentice Hall, India.

Devane, J.R. and Rimoldi, H.J.A.: Training in Problem Solving. Loyola University, Chicago, Illinois, Psychometry Laboratory, 1961.

Dewey, J.: How We Think. H. Regnery Co., 1971 (Originally published in 1910).

Dienes, Z.P.: Building Up Mathematics. Hutchinson, London, 1960.

Dienes, Z.P.: The Power of Mathematics, Hutchinson, London, 1963.

Donaldson, M.:.A Study of Children's Thinking. Tavistock Publications, 1963.

Elkind, D.: Piaget and Science Education, Washington Monthly 10(3):9-12, 1972.

Flavell, J.H. and Wohlwill, J.F.: Formal and Functional Aspects of Cognitive Development. Edited by J.H. Flavell and D. Elkind, Oxford University, New York, 1969.

Flavell, J.H.: The Developmental Psychology of Jean Piaget. D Van Noctrand Co. Inc., Princeton and London etc. 1970.

Fraisse, Paul and Piaget Jean : Experimental Psychology: Its Scope and Method. VII Intelligence, Routledge and Kegan Paul, London, 1969.

Gagne', R.M.: The Conditions of Learning. Holt, Rinchart and Winston, London, 1965.

Garrett, H.E.: Statistics in Psychology and Education, Gayabii Offset Press, New Delhi, 1979.

Ginsburg, H.and Opper, S.: Piaget's Theory of Intellectual Development - An Introduction. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1969.

Good, T.L. and Brophy, J.E.: Educational Psychology - A Realistic Approach. Holt, Rinchart and Winston, U.S.A., 1977.

Guilford, J.P.: "Psychometric Methods" second edition, McGraw-Hill Book Company, New York, 1954.

Guilford, J.P. and Fruchter, Benjamin; Fundamental Statistics in Psychology and Education. Mc-Graw-Hill, New Delhi, 1978.

Harimen, Harry, H.: 'Modern Factor Analysis' The University of Chicago Press, Chicago 37, 1960.

Hearnshaw, L.S.: Recent Studies in the Psychology of Thinking. In readings in General Psychology. Edited by Paul Halmos and Alan Uife. Routledge and Kegan Paul, London, 1959.

Humphrey, George: Directed Thinking. Dodd, Mead and Company, New York, 1948.

Inard, A. and Laurendedu, M.: Stage in Piaget's Cognitive Development Theory. Exegesis of a Concept. In D.Elkind & J.H. Flavell (Eds) Studies in Cognitive Growth: Essays in honour of Jean Piaget, New York, Oxford University Press, 1969.

Inhelder, B. and Piaget, J.: The Growth of Logical Thinking From Childhood to Adolscence, Routledge & Kegan Paul Ltd., London, 1958.

Inhelder, E.: Some Aspects of Piaget's Genetic Approach to Cognition. In Cognitive Development in Children. The University of Chicago Press, Chicago and London, 1970.

Inhelder, B., Sinclair, H. ~~and~~ Bovet, M.: Learning and the Development of Cognition. Routledge and Kegan Paul Ltd., London, 1974.

Karplus, R.: Teaching For the Development of Reasoning. The psychology of teaching for thinking and creativity. Ed.by Auton E.Lawson, Columbus, Ohio, ERIC-SMEAC, 1980.

Keats, J.A., Collis, K.F., Halford, G.S.(Ed): Cognitive Development. Research Based on a Neo-Piagetian Approach. John Willey & Sons, Chichester, New York, Brisbane,Toronto, 1978.

Kerlinger, Fred.N.: Foundations of Behavioural Research. Surjeet Publication, Kamla Nagar, Delhi, 1983.

Kuchemann, D.: 'The Pendulum'. Chelsea College NFER Publishing Co.Ltd., Windsor, London, 1977 and 1979.

Lahey, B.B. and Johnson, M.S.: Psychology and Instruction - A Practical Approach to Educational Psychology. Scott,Foresman and Company, Oakland, New Jersey, 1978.

McDonald, F.J. and Shockley, W.: Teaching Scientific Thinking at High School Level. Stanford University, California School of Education, 1964.

McGuigan, F.T.: Experimental Psychology - A Methodological Approach. Second Edition. Prentic Hall of India Pvt.Ltd., New Delhi, 1970 pg.119-148.

Modgil Sohan and Celia: Piagetian Research Compilation and Commentary in Eight Volumes), NFER, London, 1976.

Novak, J.D.: A Theory of Education. Cornell University Press, Ithaca and London, 1977.

Patterson, G.H.: Foundations For a Theory in Instructional and Educational Psychology. Harpes and Row Publishers, New York, 1977.

Peel, E.A.: The Pupils' Thinking. Old Bourne, London, 1960.

Piaget J.: The Origin of Intelligence in The Child. Routledge and Kegan Paul Ltd., London, 1953.

Piaget,J.: Logic and Psychology. Manchester University Press, Manchester, 1956.

Piaget Jean: The Psychology of Intelligence. Littlefield Adams & Co., Paterson, New Jersey, 1960.

Piaget, J.and Inhelder,B.: Mental Imagery in the Child: A Study of Development of Imaginal Representation. Routledge & Kegan Paul, London, 1971.

Pinard.A.and Laurendeau, M.: 'Stage' in Piaget's Cognitive Developmental Theory: Exegesis of a concept. In D.Elkind & J.Flavell (Eds) Studies in Cognitive Development, New York:Oxford University Press, 1969.

Pulaski, M.A.S.: Understanding Piaget: An Introduction to Children's Cognitive Development. Harper and Row, New York etc. 1971.

Reese. Hayne, W.& Lipsitt Lewis P.: Experimental Child Psychology. Academic Press, New York, 1970.

Richmond, P.G.: An Introduction to Piaget. Routledge and Kegan Paul. London, 1970.

Rimoldi, H.J.A. and et al.: Training in Problem Solving, Loyola University, Chicago, Illinois, Psychometric Laboratory, 1962.

Russell, D.H.: Children's Thinking. Ginn & Co., Boston and London etc., 1958.

Schwebel Milton and Raph Jane : Piaget in the Classroom. Routledge and Kegan Paul, London, 1974.

Sharma, R.A.: 'Technology of Teaching'. Goyal Book Depot, Meerut, 1980.

Sigel, Irving E.,and Hooper, Frank H.: Logical Thinking in Children - Research Based on Piaget's Theory. Holt, Rinehart and Winston Inc., U.S.A. 1968.

Siegel, L.S. and Brainerd, C.J. (Ed): Alternatives Piaget. Critical Essays on the Theory, Academic Press, New York, San Francisco, London, 1978.

Smith Annette Karmiloff : A Functional Approach to Child Language: A Study of Determiners and Reference, Cambridge University Press, 1979.

Smith, M.D.: Educational Psychology and Its Classroom Applications. Allun and Bacon, Inc., Boston, U.S.A., 1978.

Strauss S. : Inducing Cognitive Development and Learning: A Review of Short Term Training Experiments. I. The organismic-developmental approach. Cog., I. 329-357, 1972.

Vaidya, N.: Problem Solving in Science. New Delhi, S.Chand & Co., 1968.

Vaidya, N.: Some Aspects of Piaget's Work and Science Teaching. S. Chand & Co., Ramnagar, New Delhi, 1971.

Vaidya, N.: Science for the Adolescent. Through Project Work, Department of Teacher Education, NCERT, New Delhi, 1975.

Vaidya, N.: The Growth of Logical Thinking in Science. Oxford & IBH Publishing Company, 66, Janapath, New Delhi, 1978.

Vygotsky, L.S.: Thought and Language, Edited & Translated by Haufman et al, The M.I.T., John Wiley & Sons, Inc., New York.

Wadsworth, J. Barry: Piaget's Theory of Cognitive Development Second Edition, Longman Inc., New York, 1979.

Wallace, J.G.: Stages and Transition in Concept Development: An Experimental Study, N.F.E.R., London, 1972.

Wallace, J.G.: Concept Growth and the Education of the Child. N.F.E.R., London, 1965.

Wallach, M.A. : Research on Children's Thinking, Child Development. N.S.S.E., 1973.

Wollman, W. and Lawson, A.E.: Teaching the Procedure of Controlled Experimentation: A Piagetian Approach, 1977.

Wright, E.L. : The Effect of Film Mediated Intensive Instruction on Basic Problem Solving Skills of Ninth Graders. Paper presented at the Annual Meeting, American Educational Research Association, Toronto, Canda, March, 27-31, 1978.

Young Robertk and Veldman Donald J.: "Introductory Statistics for the Behavorial Sciences", Holt, Rinchart and Winston, Inc., United States of America, 1972.

JOURNALS

Bass, J. and Montague, E.: Piaget Based Sequences of Instruction in Science. Science Education, 1972, 56, 503-512.

Berndt, T.P. and Wood, D.J.: "The Development of Time Concept Through Conflict Based on a Primitive Duration Capacity". Child Development, 45, 825-28, 1974.

Berzonsky, M.D., Lomardo, T.P. and Ondrako, M.A.: Changes in Logical Thinking as a Function of Induced Disequilibrium. Journal of Genetic Psychology, 92, 255-60, 1975.

Brainerd, C.J. and Allen, T.W.: Training and Generalization of Density Conservation:Effects of Feed-back and Consecutive Similar Stimuli. Child Development, 42,693-704, 1971(a).

Brainerd,C.J.: The Development of the Proportionality Scheme in Children and Adolescents. Developmental Psychology,5, 469-476, 1971.

Brainerd, C.J.: Reinforcement and Reversibility in Quantity Conservation Acquisition. Psychon-Science,Vol.27(2),1972.

Brainerd, C.J.: Training and Transfer of Transitivity, Conservation and Class Inclusion of Lenth. Child Development, Vol. 45, 1974.

Brainerd, C.J.: Does Prior Knowledge of the Compensation Rule Increase Suseptibility to Conservation Training ? Developmental Psychology, Vol.12, No.1, 1976.

Brainerd, C.J.: Neo-Piagetian Training Experiments Revisited: Is There Any Support For the Cognitive Developmental Stage Hypothesis ? Cognition International Journal of Coghitive Psychology, 2(3).

Bredderman, T.A.: The Effects of Training on the Development of the Ability to Control Variables. Journal of Research in Science Teaching, 10,(3) 189-200, 1973.

Buell, R.R. and Bradley,G.A.: Piagetian Studies in Science: Chemical Equilibrium Understanding from Study of Solubility: A Preliminary Report From Secondary School Chemistry, Science Education, Vol.56, No.10, 23-29,Jan-Mar,1972.

Campbell Lawrence Hobarg: The Effects of Cognitive Strategy Training on Reading Achievement and Piagetian Cognitive Level Among High-Risk College-Freshmen. Dissertation Abstract International, Nov1983,Vol.44 pg.1398-A.

Caruso, J.L. and Resnick, C.B.: Task Structure And Transfer In Children's Learning of Double Classification Skills. Child Development, 43, 1297-1308, 1972.

Case,R. and Fry,C.: Evaluation of an Attempt to Teach Scientific Inquiry and Criticism in a Working Class High School, Journal of Research in Science Teaching,10,135-142,1973.

Case, R.: Structures and Strictures: Some Functional Limitations on the Course of Cognitive Growth. Cognitive Psychology,6, 544-573, 1974.

Davis, J.K.: Concept Identification as a Function of Cognitive Style, Complexity and Training Procedures, 1967. (Report No.CRP-2850,TR-32).

Douglass, C.B. and Kahle, J.B.: The Effects of Instructional Sequence and Cognitive Style on the Achievement of High School Biology Students. Science Education, 56, 1972.

Driver Rosalind : When is a State Not a Stage ? A Critique of Piaget's Theory of Cognitive Development and Its Application to Science Education, Educational Research, the Journal of NFER, Vol.21, No.1,Nov.,1978.

Duckcoarth, E.: Either Were Too Early and They Cannot Learn it or Were Too Late And They Know it Already: The Dilemma of "Applying Piaget". Harvard Educational Review,Vol.49, No.3, August,1979.

Edwards, C.H. and Surma, M.: The Relationship Between Type of Teacher Reinforcement and Student Inquiry Behaviour in Science. Journal of Research in Science Teaching, Vol.17, No.4,pp.337-341, 1980.

Elkind, D.: Quantity Conception in Junior & Senior High School Students, Child Development, 32, 1961.

Elkind, D.: Children's Disconvey of The Conservation of Mass Weight and Volume: Piaget Replication Study II. Journal of Genetic Psychology, 98:219-227, 1961.

Ennis, R.H., Finkelstein, M, Smith, E. and Wilson, N.: Conditional Logic and Children, Cornell Critical Thinking Readiness Project, Phase II-C, Final Report, Cornell University, Ithaca, New York, 1969.

Field, D.: "Long Term Effects of Conservation Training With Educationally Subnormal Children" Journal of Special Education,8, 3, 237-45, 1974.

Flexer, B.K. and Roberge, J.J. : A Longitudinal Investigation of Field Dependence - Independence and the Development of Formal Operational Thought. The British Journal of Educational Psychology, Vol.53, Part-2, June, 1983.

Frijda, N.H.: Stimulation of Human Long Term Memory. Psychological Bulletin, 1972.

Gholson, B., O'Connor, J. and Stern, I.: "Hypothesis Sampling Systems Among Pre Operational and Concrete Operational Kindergarten Children". Journal of Experimental Child Psychology, 21, 61-76, 1976.

Hagen, J.W., Jongeward, R.H. and Zkail, R.V.: Cognitive Perspectives on the Development of Memory. In H.W. Reese (Ed) Advances in Child Development & Behaviour, Vol.10, New York, Academic Press, 1975.

Halfard, G.S.: "Acquisition of Conservation Through Learning a Consistent Classificatory System for Quantities". Aust. Journal of Psychology, 23,2, 151-9, 1971.

Hamel, B.R. and Rikson, B.O.: "Identity, Reversibility, Verbal Rule Instruction and Conservation". Developmental Psychology, 9,1, 66-72, 1973.

Herbig Manfred: "Item Analysis by Use in Pre-test and Post-test A Comparison of Different Coefficients Programmed Learning and Educational Technology. Journal of APLET, Vol.13, No.2, Kogan, page Ltd/16a, Pentonville Road, London, N1 9JN, May, 1976.

Henle, M.: On the Relation Between Logic & Thinking. Psychological Review, 1962, 69, 366-78.

Hetherington, E.M. and McIntyre, Curtis W.: Developmental Psychology. In Roseuweig Mark K. and Porter, Lyman W. Annual Review of Psychology, Vol.26, Annual Reviews, Inc., Palo Alto, California, USA, p.98, 1975.

Howe, A.C. and Mierzwa, J.: Promoting the Development of Logical Thinking in the Classroom, Journal of Research in Science Teaching, 14(5):467-472, Sept., 1977.

Hyram, G.: An Experiment in Developing Critical Thinking in Children, Journal of Experimental Education, 26, 1957.

Jamieson, G.H.: Visual Media in a Conceptual Framework for the Acquisition of Knowledge. Programme Learning and Educational Technology Journal of APLMT, Vol.10, No.1, Jan., 1973.

Kimball : The Teaching and Understanding of Formal Operations. Paper delivered to the Third Annual Conference on 'Piaget and the Helping Professions', Children's Hospital, Los Angeles, 1973.

Kuhn, D.: Inducing Development Experimentally : Comment on a Research Paradigm, Developmental Psychology,10, 1974.

Kuhn, D. and Angelev, J.: An Experimental Study of the Development of Formal Operational Thought. Child Development, Vol.47, 1976.

Lancaster, R.P. and McManis, D.L.: Training of Number Conservation in Retardates. Journal of Psychology, 83, 303-313, 1973.

Lawson, A.E., Nordland, F.H. and Devito, A.: Piagetian Formal Operational Tasks: A Crossover Study of Learning Effect and Reliability. Science Education, 1974,58,267-276.

Lawson, A.E., Blake, A.J.D. and Nordland, F.H.: Training Effects and Generalization of the Ability to Control Variables in High School Biology Students, Science Education,59,387-396, 1975.

Lee, C. bee : The Concomitant Development of Cogntive and Moral Modes of Thought: A Test of Selected Deductions From Piaget's Theory. Journal of Genetic Psychology Moneg. 83, 93-146, 1971.

Leskow, S. and Smock, C.D.: Developmental Changes in Problem Solving Strategies. Permutations Development Psychology, 1970, 2, 412-22.

Linn, M.C. and Thier, H.D.: The Effect of Experimental Science on the Development of Logical Thinking in Children. Journal of Research in Science Teaching,12, 49-62,1975.

Linn, M.C., Chen, B. and Thier, H.D.: Teaching Children to Control Variables: Investigation of a Free Choice Environment. Journal of Research in Science Teaching, 15, 1976.

Linn, M.C. and Levine, D.I.: Adolescent Reasoning: The Development of the Ability to control Variables, Advancing Education Through Science Oriented Programs. Report P Sc-9, Lawrence Hall of Science, Berkeley, 1976.

Linn, M.C., Chen, B and Thier, H.D.: Teaching Children to Control Variables: Investigation of a Free-Choice Environment. Journal of Research in Science Teaching, Vol.10, No.3, pp 249-255, 1977.

Lunzer, E.A. and Coombes, M.G.: Teaching for Formal Reasoning. Paper read at Annual Conference, British Psychological Society (Education Section), London, 12-14th September, 1969.

Miller, S.A., Schwartz,J. and Stewart, C.: An Attempt to Extinguish Conservation of Weight in College Students. Developmental Psycholoy 8, 2, 316, 1973.

Nagg Philip, Griffiths Alan, K: Limitations of Recent Research Relating Piaget's Theory to Adolescent Thought. Review of Educational Research, The American Educational Research Association, Vol. 52, No.4, Winter, 1982.

Nasca, D.: Effect of Varied Presentations of Laboratory Exercises Within Programmed Materials on Specific Intellectual Factors of Science Problem Solving Behaviour. Science Education, 50:437-457, December, 1966.

Neimark, E.D.: Intellectual Development During Adolescence. In F.D. Horowitz (Ed) Review of Child Development Research (Vol.4), Chicago:University of Chicago Press, 1975(a).

Padmini, M.S. and N. Vaidya; A Factor-Analytic View of Adolescent Thought in Piagetian Context. The Educational Trends, Vol.14, No.2, July, 1979, 25-34.

Peterson, K.D.: An Experimental Evaluation of a Science Inquiry Training Programme for High School Students. Developmental Psychology, 2, 1970.

Physical Science Study Committee : Physics, Second Edition, Part III. India by Maps and Atlases. Publications P.Ltd., Madras, 1966.

Pufall, P.B.: Introduction of Linear-Order Concepts: A Comparison of Three Training Techniques, Child Development, 44, 642-45, 1973.

Quinn, M.E.: Hypothesis Formation Can be Taught. The Science Teacher, Vol.39, No.6, Sept., 1972.

Rastovac, J.J.: The Effect of Instructional Mode on School Achievement of Concrete and Formal Operational Students. Journal of Experimental Psychology 21, 1976.

Raven, R.J.: Programming Piaget's Logical Operations for Science Inquiry and Concept Attainments. Journal of Research in Science Teaching, 11, 251-261, 1974.

Renner, J.W. and Lawson, A.E.: Promoting Intellectual Development Through Science Teaching. The Physics Teacher, 11, 273-276, 1973.

Renner, J.W.: Significant Physics Content and Intellectual Development - Cognitive Development as a Result of Interacting With Physics Content, The Physics Teacher, 15, 1974.

Ripple, Richard et al.: Piaget Re-discovered. Journal of Research in Science Teaching, Vol.II, Issue 3, 1964.

R. Roberts Tessa: Piagetian Theory and the Teaching of Reading Educational Research. The Journal of the NFER, Vol.26, No.2, June, 1984.

Rothenberg, B.B. and Orost, Jean H.: The Training of Conservation of Number in Young Children. Child Development, No. 707-26, 1969.

Shayer, M.: Has Piaget's Construct of Formal Operational Thinking and Utility ? British Journal of Educational Psychology, 49, 1979.

Sheppard, J.L.: "The Child's Concept of Horizontality With Water Levels: A Training Study". Aust. Journal of Pschology, 26, 191-98, 1974(9).

Siegler, R.S., Liebert, D.E. and Liebert, R.M.: Inhelder and Piaget's Pendulum Problem : Teaching Pre-adolescents to Act as Scientists. Developmental Psychology, 9, 97-101, 1973.

Siegler, R.S. and Liebert, R.M.: Aquisition of Formal Scientific Reasoning by 10 and 13 Year Olds: Redesigning a Factorial Experiment. Developmental Psychology, 11, 401-402, 1975.

Silver, E.: Relations Among Piagetian Grouping Structures : A Training Study. Journal for Research in Mathematics Education, 7,5, 308-314, Nov., 1976.

Simcox, N.M.: Improvement in the Logic of Eight-Year-Old Children. Education Review 23, 69-77, 1970.

Srivastava, G.N.: Jean Piaget on Cognitive Development of Child. The Asian Journal of Psychology and Education. Agra Psychological Research Cell, Tiwari Kothi, Belanganj, Agra, Vol.10, No.1-4, 1982.

Stone, C.A. and Day, C.M.: Levels of Availability of Formal Operational Strategy. Child Development, 1978, 49, 1,054-1,065.

Strauss, S. and Rimall, I.: Effects of Organizational Disequilibrium Training on Structural Elaboration. Developmental Psychology, Vol.10, No.4, 1974.

Sullivan, Edmund, V. (1967): Experiments in the Acquisition of Conservation of Substance: An Overview in Perison,D.W. and Sullivan, E.V.(Eds) Recent-Research on the Acquisition of Conservation of Substance. Ontario Institute of Studies in Education, 1-10. 1967.

Tomlinson-Keasey, C.: Formal Operations in Females From Eleven to Fifty-Four Years of Age. Developmental Psychology, 1972, 6, 364.

Warrent, T., Wollman, W and Lawson, A.E.: The Influence of Instruction on Proportional Reasoning in Seventh Graders. Journal of Research in Science Teaching 15, 1977.

Wason, P.C. and Shapiro, D.: Natural and Contrived Experience in a Reasoning Problem. Quarterly Journal of Experimental Psychology, 23, 69-71, 1971.

Wollman, W. and Lawson,A.E.: Teaching the Procedure of Controlled Experimentation: A Piagetian Approach. Science Education, 61(1), 1977.

Wollman, W.: Intellectual Development Beyond Elementary School VI - Controlling Variables: A Survey. School Science and Mathematics Science Education, 63, 1978.

Wheeler, A.E. and Kass, H.: Proportional Reasoning in Introductory High School Chemistry. Science Teaching, 14, 1977.

RESEARCH WORK

Anfin Carol Steele : A comparison of the Effectiveness of Direct Contact With Children in the Class Room Versus Indirect Contact Via Videotape in Piagetian Conservation Tasks in Preservice Teachers. Dissertation Abstract International A The Humanities and Social Sciences, University Microfilms International, July, 1976, Vol.37 pg. 231

Bank, S.H.: How pupils in a Secondary Modern School Induce Scientific Principles from Science Experiments. Unpublished Dissertation, Birmingham University, 1958.

Bawa, Gurbans Singh: The Effect of Training and Intelligence on Formal Operational Thought (Starting and Testing Hypotheses). M.A. Dissertation, Punjabi University, Patiala, 1980-81.

Beilin, H.: The Training and Acquisition of Logical Operations. In M.F. Rosskopf, L.P. Steffe & S. Taback (Eds) Piagetian Cognitive Development Research & Mathematical Education, Washington National Council of Teachers of Mathematics, 1971.

Brison, David W. and Bereiter, Card; Acquisition of Conservation of Substance in Normal Retarded and Gifted Children. In Brison, D.W. and Sullivan, E.V. (Eds) Recent Research on the Acquisition of Conservation of Substance. Ontario Institute for Studies in Education, 53-72, 1967.

Dyrli, O.E.: An Investigation Into the Development of Combinational Mechanisms Characteristic of Formal Reasoning Through Experimental Problem Situation With Sixth Grade Students, Unpublished Doctoral Dissertation, Indiana University, Bloomington, 1967.

Foley, E.A.: The Effects of Training in Conservation of Tonal and Rhythenic Patterns of Second-grade Children. Diss. Abstr. 35, 7 3941A-4780A (4584A), 1975.

Geeslin, K.E.: An Analysis of Content Structure and Cognitive Structure in the Context of a Probability Unit. Paper presented at the Annual Meeting of the National Council of Teachers of Mathematics, Atlantic City, New Jersey, April, 1974.

Gunnels, F.G.: A Study of the Development in Logical Judgements in Science of Successful and Unsuccessful Problem Solvers' in Grades Four Through Nine. Unpublished Doctoral Dissertation, University of Alabama, Tuscaloosa, 1967.

Hamilton, B.B.: Control of the Conservation Responses Through Discrimination Learning Set Training For Conservation and Non-Conserving Transformation. Diss.Abstr.,34, 4, 1407A-2071A (1700A) Xerox University, Microfilms (1973).

Koon, R.B.: A Study of the Role of Manipulatory Grouping Experience in the Classification Skill Development of Young Children. Diss.Abstr.,34, 10, 6171A-6792A (6360A) Xerox University, Microfilms, 1974.

Mumford, S.C. : Factors Involved in Problem Solving With Special Reference to the Problem of Insight. Ph.D.Thesis, London, 1937.

Neal, L.A.: D.Ed.Thesis Reported in Science Education, Oct., 1961 (pp.313-320).

Raizada Vandana: A Study of Relationship Between Problem Solving and Some Relative Personality Traits Using Piagetian-Type Task. M.Ed. dissertation, University of Rajasthan, Jaipur, 1980-81.

Riesz Elizabeth Dunkman : The Effect of Training on Children's Classification Skills. Dissertation Abstract International A University Microfilm International. January, 1982, Vol.42, pg. 3081-A.

Robert, K., Lawson, A.E., Wallman, W., Appel, M., Bernoff,R., Howe, A., Rusch, J.J. and Sullivan, F.: Science Teaching and the Development of Reasoning - A Workshop Report Lawrence Hall of Science, University of California, Berkeley, California, 1979.

Shavelson, R.J.: Some Aspects of the Relationship Between Content Structure and Cognitive Structure in Physical Instruction. Ph.D. Dissertation, Stanford University,1971.

Slesnick Twila: Algorithmic Skills Versus Conceptual Understanding. Unpublished Doctoral Dissertation, University of California, Berkeley, 1980.

Sneider Cary Ivan : Can Children Learn How to Control Variables? A Neo-Piagetian Training Study in School and Non-School Settings. Dissertation Abstr.International A University Microfilm International Canada, Feb.,1983,Vol.43, pg. 2623-A.

Tellsayon, V.M.: Some Cognitive Variables in Meaningful Learning of the Physics Concepts of Work and Energy: A Study of Ausubelian Learning Model. Dissertation Abstr. Vol.33:9,p.4970-A, 1973.

Vaidya, N.: A Study of Some Aspects of Thinking Among Science Students of Adolescent Age. Unpublished Ph.D. Thesis, University of Rajasthan, Jaipur, 1974.

Wiegand, U.K.: A Study of Subordinate Skills in Science Problem Solving. Unpublished Doctoral Dissertation, University of California, Berkeley, 1969.

Wyatt Mollie : Formal Operational Thinking and the Role of Training. Dissertation Abstr. International A University Microfilm International Canada. January, 1983, Vol.43, pg.2257-A.

ANNEXURE I

S. No.	Code No.	Age	SES	INT	M.S.P.Q. A	B	C	D	E	F	G	H	I	J	O	Q_2	Q_3	Q_4	Stimulating Prob. 1	2	3	4	Total	Pre Test 1	2	3	4	5	Total	Post Test 1	2	3	4	5	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Cb 1	10	18	33	7	7	8	7	6	10	2	5	5	4	6	6	5	7	8	12	5	0	25	1	1	1	3	3	9	2	2	2	2	2	10
2	Cb 2	10	18	32	7	5	7	7	5	4	6	4	2	2	7	6	6	5	7	11	10	10	38	1	1	1	3	3	9	2	2	1	2	0	7
3	Cb 3	10	19	32	5	1	5	6	8	4	4	5	5	4	6	7	3	8	7	11	9	10	37	1	1	3	3	3	11	1	2	1	3	3	10
4	Cb 4	10	19	32	7	3	6	5	4	6	3	3	3	1	6	4	6	5	7	12	4	10	33	1	1	1	1	1	5	3	3	1	0	0	7
5	Cb 5	10	16	32	7	7	5	6	5	4	4	4	2	3	7	6	6	5	9	14	8	5	36	1	1	1	3	1	7	1	1	1	1	1	5
6	Cb 6	10	18	32	7	5	7	7	5	4	4	4	2	2	7	6	6	5	9	12	7	10	38	1	1	1	1	1	5	1	1	1	1	1	5
7	Cb 7	10	17	32	5	4	7	6	6	5	4	3	3	5	6	6	4	5	9	12	9	10	40	1	3	1	1	1	7	2	1	1	1	1	6
8	Cb 8	9	19	31	6	5	4	6	5	4	2	5	2	1	7	6	4	6	9	15	7	15	46	1	3	3	3	3	13	1	2	3	3	1	10
9	Cb 9	10	16	31	6	7	5	7	5	4	4	5	5	4	2	7	3	5	10	12	11	10	43	1	1	1	1	1	5	1	1	1	1	1	5
10	Cb 10	10	19	31	5	5	4	6	5	6	1	1	3	4	6	7	2	5	7	12	9	10	38	1	1	1	3	3	9	2	2	1	3	1	9
11	Cb 11	10	16	30	3	3	4	6	3	1	3	5	7	5	7	5	4	4	7	12	9	8	36	1	1	1	1	1	5	1	1	1	1	1	5
12	Cb 12	10	21	30	5	7	4	6	6	6	4	5	2	1	6	5	5	5	8	13	10	10	41	1	3	1	1	1	7	2	2	1	1	1	7
13	Cb 13	10	22	30	5	5	4	6	6	2	2	4	3	4	6	6	5	5	4	7	10	10	31	1	3	1	3	3	11	3	3	1	0	0	7
14	Cb 14	10	17	29	6	5	4	7	3	5	5	2	5	4	5	7	3	4	9	10	6	10	35	1	1	1	1	1	5	1	1	2	2	2	8
15	Cb 15	10	19	29	6	4	5	7	5	3	3	3	2	2	8	4	5	5	7	9	9	0	25	1	1	1	1	1	5	1	1	3	3	1	9
16	Cb 16	10	18	28	6	5	3	7	4	5	4	3	4	4	4	6	2	4	12	12	9	0	33	1	1	1	1	1	5	2	2	1	2	2	9
17	Cb 17	10	22	26	5	4	6	7	3	2	4	5	2	3	4	8	5	5	5	4	7	3	19	1	1	3	1	1	7	1	1	3	3	1	9
18	Cb 18	9	20	24	6	7	4	5	4	3	3	5	4	1	6	6	4	4	8	10	8	10	36	1	1	3	3	3	11	1	1	3	1	2	8
19	Cb 18	10	17	24	5	4	5	3	7	8	6	5	1	4	3	6	3	4	7	5	9	0	21	1	1	1	1	1	5	1	1	1	1	1	5
20	Cb 20	10	20	23	5	5	4	6	5	6	1	1	3	4	6	7	2	5	9	10	6	10	35	0	1	3	3	1	8	1	2	3	3	1	10

Contd....

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
21	Cb	21 11	16	40	5	7	5	5	6	6	4	7	5	6	5	6	6	3	8	14	9	11	42	1	1	1	1	1	5	1	1	1	1	1	5
22	Cb	22 11	16	40	7	5	4	8	4	6	5	5	6	8	6	4	8	5	9	13	9	6	37	1	1	1	1	1	5	1	1	1	1	1	5
23	Cb	23 11	14	40	6	5	5	8	4	5	4	3	5	8	8	6	3	8	12	14	10	11	47	1	1	1	1	1	5	3	3	2	3	1	12
24	Cb	24 11	18	44	5	5	3	5	3	6	7	4	6	3	4	3	6	5	7	12	10	10	40	1	1	1	1	1	5	1	1	1	1	1	5
25	Cb	25 10	18	45	4	5	5	4	6	8	5	6	5	5	4	2	4	6	7	13	7	11	38	1	1	1	1	1	5	1	1	1	1	1	5
26	Cb	26 11	15	45	5	5	4	7	3	5	4	3	5	4	6	6	6	5	8	12	4	10	34	1	1	1	1	1	5	1	1	1	1	1	5
27	Cb	27 11	16	45	8	5	5	4	7	7	7	5	6	4	3	6	5	5	8	14	10	10	42	1	1	1	1	1	5	1	1	1	1	1	5
28	Cb	28 11	14	44	6	3	4	7	3	4	5	3	3	5	7	4	3	5	6	11	6	15	38	1	1	1	1	1	5	2	1	1	1	1	6
29	Cb	29 11	14	45	5	7	4	9	3	7	4	4	3	4	8	6	5	6	7	12	9	10	38	1	1	1	1	1	5	1	1	1	1	1	5
30	Cb	30 11	17	44	8	9	5	4	6	5	4	8	6	2	6	2	4	4	12	15	12	15	54	1	1	1	1	1	5	1	3	1	3	1	9
31	Cb	31 10	15	43	4	3	6	6	5	3	5	4	6	4	6	5	6	6	9	11	7	15	42	1	1	1	1	1	5	2	1	1	3	1	8
32	Cb	32 11	19	43	5	7	2	6	3	4	6	3	2	5	5	6	6	5	10	14	11	15	50	1	1	1	1	1	5	1	1	1	1	1	5
33	Cb	33 11	13	43	7	7	2	9	3	7	2	4	4	7	6	6	5	6	6	11	7	15	39	1	1	1	1	1	5	1	1	1	1	1	5
34	Cb	34 11	19	43	5	4	5	3	7	8	6	5	1	4	3	6	3	4	8	11	11	15	45	1	1	1	1	1	5	1	1	1	1	1	5
35	Cb	35 11	14	42	4	3	4	4	6	6	7	5	6	6	5	4	3	4	6	14	10	10	40	1	1	1	1	1	5	1	1	1	1	1	5
36	Cb	36 11	18	42	6	3	4	6	5	6	4	5	5	8	8	6	6	7	11	12	10	8	41	1	1	1	1	1	5	2	1	1	3	1	8
37	Cb	37 11	18	42	5	3	4	7	2	6	5	3	3	5	7	4	3	5	9	13	10	10	42	2	2	2	2	1	9	2	2	2	2	1	9
38	Cb	38 11	18	41	4	5	6	5	4	6	4	4	5	4	6	6	5	5	12	13	9	11	45	1	1	1	1	1	5	1	3	1	3	1	9
39	Cb	39 11	18	37	5	5	5	5	6	5	7	5	5	7	2	4	6	4	8	15	10	10	43	1	1	1	1	1	5	1	1	1	1	1	5
40	Cb	40 10	18	29	6	4	5	7	5	3	3	3	2	2	8	4	5	5	14	13	10	6	43	1	1	1	1	1	5	1	1	1	1	1	5

Contd...

1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
41	Cb	41	12	18	47	5	4	10	6	3	4	4	6	1	8	4	8	6	9	12	15	15	15	[illegible]	1	1	1	1	1	5	3	1	3	3	3	13
42	Cb	42	11	19	47	6	7	6	4	5	6	5	4	4	4	5	6	4	6	13	15	11	15	54	2	2	1	1	1	7	2	2	1	2	2	9
43	Cb	43	12	18	46	7	4	8	4	3	4	4	6	3	3	4	5	4	4	8	13	11	5	37	1	1	1	1	1	5	2	1	1	1	1	6
44	Cb	44	12	16	46	3	4	5	6	6	2	5	6	4	4	7	4	9	5	8	11	6	10	35	1	1	1	1	1	5	1	1	1	1	1	5
45	Cb	45	12	19	45	3	5	5	6	4	3	4	5	6	2	6	6	7	4	12	7	9	13	42	1	1	2	1	1	6	1	1	1	1	1	5
46	Cb	46	12	16	45	3	5	5	9	6	6	5	6	5	4	6	6	5	4	11	13	10	13	44	1	1	1	1	1	5	2	1	3	2	2	10
47	Cb	47	12	16	45	4	5	6	6	5	5	7	7	1	4	8	5	7	5	14	13	13	11	51	1	1	1	1	1	5	1	3	2	2	1	9
48	Cb	48	11	19	44	3	4	5	3	2	6	4	5	5	3	6	4	7	4	11	12	9	6	38	2	2	2	2	2	10	2	2	2	2	2	10
49	Cb	49	12	16	44	8	4	8	6	5	4	7	6	7	5	6	5	6	5	11	15	12	0	38	1	3	1	1	1	7	1	3	1	1	1	7
50	Cb	50	12	22	44	7	4	7	4	1	5	5	6	7	7	5	4	6	3	8	14	10	3	35	1	2	2	2	1	8	2	2	2	2	2	10
51	Cb	51	12	14	44	5	7	5	7	6	8	7	6	6	7	7	7	6	5	12	15	7	0	34	1	2	2	1	2	8	2	1	2	1	2	8
52	Cb	52	12	19	43	5	7	8	7	3	4	5	7	7	4	4	2	4	4	14	15	10	10	49	1	1	1	1	1	5	1	1	1	2	2	7
53	Cb	53	12	22	43	6	4	4	3	3	8	7	7	7	7	5	3	6	4	13	14	12	15	54	1	2	2	1	1	7	2	2	2	1	2	9
54	Cb	54	11	19	43	6	5	6	6	5	4	5	7	4	4	5	4	7	7	8	15	11	13	47	1	1	1	1	1	5	1	3	1	1	1	7
55	Cb	55	11	20	43	4	7	6	4	5	6	3	6	9	6	6	6	4	5	7	15	9	6	37	1	1	1	1	1	5	1	1	1	1	1	5
56	Cb	56	11	19	42	3	6	7	5	3	6	6	5	3	5	7	3	6	5	12	12	6	8	38	1	1	1	1	1	5	1	1	1	1	1	5
57	Cb	57	11	18	42	4	7	5	5	4	8	5	6	5	4	3	6	4	2	9	15	12	6	42	1	1	1	1	1	5	1	3	1	1	1	7
58	Cb	58	12	19	42	6	3	4	6	5	6	4	5	5	8	8	6	6	7	12	7	9	13	41	1	1	1	1	1	5	2	2	2	2	2	10
59	Cb	59	12	19	47	8	5	8	6	5	7	6	7	4	4	4	6	8	7	12	14	14	0	40	1	1	1	1	1	5	1	1	1	1	1	5

Contd....

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
60	Cb 60	13	18	51	5	8	4	7	6	9	4	6	5	7	5	5	8	5	11	15	10	11	47	2	2	2	2	2	10	2	2	2	2	2	10
61	Cb 61	13	20	51	4	5	7	7	5	4	7	6	7	5	7	3	4	7	8	14	9	13	44	1	1	1	1	1	5	1	2	1	1	1	6
62	Cb 62	13	17	51	3	4	6	3	2	6	5	6	5	5	3	6	5	4	12	14	12	8	46	1	1	1	1	2	6	2	1	2	1	2	8
63	Cb 63	13	16	50	5	2	4	7	8	6	3	2	6	6	7	5	4	7	7	15	12	15	49	1	1	1	1	1	5	1	1	1	1	1	5
64	Cb 64	12	19	49	5	3	7	4	5	6	7	3	2	5	5	5	7	5	7	13	12	15	47	1	1	1	1	1	5	1	1	1	1	1	5
65	Cb 65	13	18	48	9	5	8	4	3	5	5	7	4	7	4	6	7	4	10	13	10	15	48	2	2	2	2	2	10	1	1	1	1	1	5
66	Cb 66	13	18	48	5	5	7	5	5	7	5	6	7	4	8	4	6	5	9	15	10	11	45	1	1	2	2	2	8	1	1	1	1	1	5
67	Cb 67	12	21	47	8	5	8	3	3	4	6	7	5	5	7	6	7	7	12	15	11	15	52	1	1	1	1	1	5	1	1	1	1	1	5
68	Cb 68	13	15	47	8	2	8	3	5	6	7	7	6	6	2	3	8	3	7	11	6	8	32	1	2	2	2	2	9	1	1	2	2	2	8
69	Cb 69	13	18	45	5	5	6	4	5	5	5	5	6	6	4	4	7	4	9	13	12	6	40	2	2	2	0	2	8	3	1	3	3	2	12
70	Cb 70	13	16	45	6	4	7	3	3	4	7	7	4	6	5	2	7	3	10	14	10	11	45	2	2	3	3	2	12	2	2	3	3	2	12
71	Cb 71	12	21	44	4	7	3	5	4	6	2	5	9	6	9	1	6	7	10	14	9	6	39	2	2	2	2	2	10	2	2	2	2	2	10
72	Cb 72	13	15	44	5	4	6	6	5	6	3	5	7	6	9	3	5	8	9	13	11	6	39	1	2	2	2	2	9	2	2	2	2	2	10
73	Cb 73	13	19	43	3	3	5	4	7	7	3	6	2	5	5	5	5	7	8	13	8	11	40	2	2	2	2	2	10	2	2	2	2	1	9
74	Cb 74	13	15	43	7	5	7	6	4	4	4	4	6	4	6	4	8	8	10	14	11	11	46	2	1	1	1	1	6	1	1	1	1	1	5
75	Cb 75	13	19	43	5	5	8	4	5	9	5	6	7	9	8	3	7	4	8	14	14	6	42	1	2	2	2	2	9	2	2	2	2	2	10
76	Cb 76	12	21	42	4	2	5	3	6	6	5	6	6	5	7	2	7	4	11	15	10	6	42	2	2	2	2	2	10	2	2	2	2	2	10
77	Cb 77	13	22	42	6	3	7	7	7	3	5	6	6	4	5	2	4	4	9	13	10	6	38	1	2	2	1	1	7	1	1	1	3	1	7
78	Cb 78	13	20	42	4	4	5	6	2	1	5	5	3	5	8	6	7	3	9	12	8	15	44	1	1	2	2	2	8	1	1	1	1	1	5

contd....

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
79 Cb	79	14	21	56	7	4	9	3	6	6	7	7	6	6	2	3	6	3	9	11	12	6	38	1	1	1	1	2	6	1	2	1	2	3	9
80 Cb	80	14	21	55	7	4	9	5	2	3	5	6	3	3	7	5	6	2	11	15	10	15	51	1	1	1	1	1	5	1	1	1	1	3	7
81 Cb	81	14	19	54	7	3	9	5	3	6	5	7	5	6	4	2	2	4	15	14	14	15	58	2	1	1	1	1	6	2	2	1	2	3	10
82 Cb	82	13	21	53	7	4	8	7	7	9	4	7	8	7	8	6	5	6	12	15	12	10	49	2	1	2	1	1	7	2	2	2	2	2	10
83 Cb	83	13	17	53	5	3	7	6	5	6	5	7	1	4	7	1	5	4	9	14	10	10	43	1	1	1	1	2	6	2	1	2	1	3	9
84 Cb	84	14	23	53	7	3	5	4	3	4	6	6	3	3	4	5	5	5	9	11	8	6	34	2	2	2	2	2	10	2	2	2	2	2	10
85 Cb	85	14	19	52	2	3	6	6	6	2	3	5	6	5	4	5	2	5	10	14	12	12	48	1	1	1	1	1	5	2	1	3	1	2	9
86 Cb	86	14	17	52	7	7	5	4	5	5	5	7	7	7	4	4	8	5	9	15	10	15	49	1	1	2	1	1	6	1	2	2	1	2	8
87 Cb	87	13	21	51	5	8	5	3	3	2	5	6	6	5	6	3	7	4	11	15	11	15	52	2	1	2	1	1	7	2	2	2	2	2	10
88 Cb	88	14	18	51	2	5	4	7	6	3	4	1	9	7	10	6	3	6	13	15	12	15	55	2	1	1	1	1	6	1	2	2	2	1	8
89 Cb	89	14	19	51	7	5	9	4	8	8	5	5	7	4	5	4	4	4	14	13	11	15	53	1	1	1	1	1	5	1	1	2	1	1	6
90 Cb	90	14	18	51	8	8	7	3	5	8	4	8	3	5	3	6	7	2	11	15	11	15	52	2	2	2	2	2	10	2	2	2	2	1	9
91 Cb	91	14	22	50	7	7	5	6	10	5	5	5	7	6	6	6	3	6	10	14	12	6	42	1	1	2	1	1	6	1	1	1	1	1	5
92 Cb	92	14	16	48	7	2	1	6	4	8	4	6	7	5	2	5	5	7	11	9	11	15	46	1	0	2	2	2	7	1	1	1	1	1	5
93 Cb	93	14	16	48	7	5	7	3	7	4	7	5	7	4	10	7	6	6	10	15	11	15	51	2	2	2	2	1	9	2	2	3	2	2	11
94 Cb	94	13	18	47	4	4	5	6	7	4	4	5	6	7	6	2	5	6	12	10	11	3	36	1	2	2	1	1	7	1	1	1	1	1	5
95 Cb	95	14	19	46	5	4	1	7	3	6	4	3	7	9	8	4	3	8	14	15	7	15	51	2	2	2	2	2	10	3	3	3	3	2	14
96 Cb	96	13	21	45	8	4	5	7	7	7	1	2	5	8	6	6	4		11	14	9	6	40	2	2	2	2	2	10	2	2	2	2	2	10
97 Cb	97	14	16	42	7	5	7	4	5	4	6	4	6	3	6	3	9		11	15	14	15	55	2	2	2	2	2	10	2	3	3	2	2	12

Contd....

348.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
98	Cb 98	15	18	57	8	5	10	6	3	4	6	6	5	8	6	7	2	7	15	14	15	15	59	2	2	2	2	2	10	2	1	1	1	1	6
99	Cb 99	15	18	55	7	4	9	5	2	3	5	6	1	5	7	5	6	6	14	14	11	15	54	1	1	1	1	1	5	2	2	1	1	1	7
100	Cb100	15	20	53	6	8	6	5	8	4	6	7	5	5	6	3	6	6	15	15	13	15	58	1	1	1	1	1	5	1	1	1	1	1	5
101	Cb101	15	20	53	6	4	7	6	4	6	5	5	5	6	5	3	6	6	14	14	11	15	54	1	1	1	1	1	5	1	1	1	1	1	5
102	Cb102	14	17	51	4	5	6	7	5	4	5	6	5	6	6	6	6	5	13	14	10	15	52	1	1	1	1	1	5	1	1	1	1	1	5
103	Cb103	15	18	50	8	4	8	4	3	3	7	7	5	6	4	4	7	4	10	13	11	15	49	1	1	1	1	1	5	2	2	2	1	1	8
104	Cb104	15	17	50	7	3	9	5	6	6	7	9	7	4	3	2	8	4	12	14	11	15	52	3	3	3	3	2	14	1	3	1	1	1	7
105	Cb105	14-19		49	6	3	4	6	4	2	5	5	2	5	5	6	6	5	14	15	12	15	54	1	0	1	1	1	4	1	1	1	1	1	5
106	Cb106	15	17	49	7	7	5	4	5	5	5	7	7	7	4	4	8	5	13	15	15	15	58	1	1	1	1	1	5	1	1	1	1	1	5
107	Cb107	15	18	49	9	5	8	4	3	5	5	8	4	7	4	6	7	4	13	13	11	15	52	1	1	1	1	1	5	1	2	2	2	1	8
108	Cb108	15	17	48	7	2	1	6	9	8	4	6	7	5	2	5	5	7	10	14	11	15	50	1	2	2	3	2	10	1	1	1	1	2	6
109	Cb109	15	17	48	7	5	7	3	7	4	7	5	7	4	10	7	6	6	14	15	8	15	52	1	1	1	1	1	5	1	1	1	1	1	5
110	Cb110	15	21	48	6	4	4	3	3	8	7	7	7	7	5	3	6	4	14	15	10	15	54	1	1	1	1	1	5	2	1	2	2	2	9
111	Cb111	15	19	47	4	4	5	6	7	4	4	5	6	7	6	5	6	7	14	14	11	15	54	1	2	3	1	1	8	2	1	1	1	1	6
112	Cb112	15	18	46	4	4	5	6	7	4	4	5	6	7	6	2	5	6	13	15	12	15	55	1	2	1	1	1	6	1	1	1	1	1	5
113	Cb113	15	19	45	5	5	8	4	5	9	5	6	7	9	7	8	3		12	15	10	15	52	1	1	1	1	1	5	1	1	1	3	2	8
114	Cb114	15	17	45	3	6	7	5	3	6	6	5	3	5	7	[illegible]	6	4	10	15	11	15	51	1	1	1	1	1	5	1	1	1	1	1	5
115	Cb115	15	18	44	4	2	5	3	6	6	5	6	6	5	7	1	7	4	14	15	9	15	53	1	3	2	2	1	9	1	2	3	1	1	8
116	Cb116	14	19	43	4	3	3	5	2	6	5	7	6	7	7	5	3	5	14	15	12	15	56	1	3	3	2	1	10	1	2	3	1	1	8
117	Cb117	15	18	43	5	7	5	8	5	9	4	7	1	5	3	5	6	8	11	14	10	15	50	1	1	1	1	1	5	1	1	1	1	1	5

ANNEXURE I

S. No.	Code No.	AGE/SES		INT	H.S.P.Q.														STIMULATING PROB.					PRE TEST						POST TEST					
					A	B	C	D	E	F	G	H	I	J	O	Q_2	Q_3	Q_4	1	2	3	4	TOTAL	1	2	3	4	5	TOTAL	1	2	3	4	5	TOTAL
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	Cg 1	10	18	32	3	4	4	5	4	4	1	4	2	3	7	8	2	8	9	9	10	3	31	1	1	0	1	1	4	1	1	1	1	1	5
2	Cg 2	10	16	23	4	3	3	7	7	4	2	3	2	4	5	5	5	7	12	15	10	13	45	1	1	1	1	1	5	1	1	1	2	1	6
3	Cg 3	10	12	28	4	4	5	4	5	7	2	5	4	3	7	5	6	5	6	10	6	15	37	1	1	1	1	1	5	1	1	1	2	1	6
4	Cg 4	10	18	28	6	1	5	7	6	4	3	5	4	6	6	3	4	9	12	12	9	3	36	1	1	1	2	1	6	1	1	1	2	1	6
5	Cg 5	9	15	25	2	7	3	3	7	3	1	5	4	6	7	5	3	5	5	12	9	10	36	1	1	1	1	1	4	1	1	1	1	2	6
6	Cg 6	10	15	24	3	1	4	6	4	4	3	4	7	5	9	5	3	7	8	10	8	10	36	1	1	1	1	1	5	1	1	3	1	1	7
7	Cg 7	10	19	23	4	3	4	5	6	4	2	4	4	4	6	7	3	6	7	5	9	3	24	1	1	1	1	1	5	1	1	1	1	1	5
8	Cg 8	10	20	23	5	1	4	3	5	4	4	5	3	6	5	4	7	7	7	5	9	3	24	1	1	1	1	1	6	1	1	3	1	1	7
9	Cg 9	10	17	22	7	4	4	5	6	6	3	4	4	5	6	5	4	10	7	5	9	6	27	1	1		1	1	4	1	1	1	1	1	5
10	Cg 10	10	17	19	6	7	6	10	7	5	2	4	8	7	4	8	4	5	6	6	7	12	31	1	1	1	1	1	5	1	1	3	1	1	7
11	Cg 11	10	19	18	4	4	6	3	6	5	2	4	4	6	6	6	5	10	6	11	9	10	36	2	1	2	1	1	7	1	1	2	1	1	6
12	Cg 12	10	20	18	4	4	5	7	8	7	6	6	4	4	4	6	2	8	7	12	7	15	41	1	1	1	1	1	5	1	1	1	1	1	5
13	Cg 13	9	20	17	4	4	3	7	6	3	4	4	2	3	7	2	2	5	6	11	9	10	36	1	2	1	1	1	6	1	1	1	3	2	8
14	Cg 14	9	18	17	6	3	4	5	6	5	5	3	5	7	5	2	6	9	6	8	7	10	31	1	1	2	2	1	7	3	3	3	1	1	11
15	Cg 15	10	15	16	4	3	5	5	6	4	3	4	4	6	4	5	3	7	7	12	9	11	39	1	1	1	1	1	5	1	1	1	3	1	7
16	Cg 16	9	17	16	6	4	7	9	5	5	3	4	4	6	6	3	3	5	9	9	7	15	40	1	2	2	1	1	7	1	1	1	3	1	7
17	Cg 17	10	15	15	2	1	4	3	6	5	1	8	4	7	6	8	6	6	7	12	9	11	39	1	1	1	1	1	5	1	1	1	2	1	6
18	Cg 18	10	15	14	7	4	1	6	6	4	5	5	1	2	3	4	6	5	6	11	6	6	29	1	1	1	1	0	4	1	1	1	3	1	7
19	Cg 19	10	21	13	3	4	2	7	5	7	4	5	6	6	5	7	4	10	6	11	9	10	36	2	1	1	2	1	7	1	1	1	1	1	5
20	Cg 20	10	26	12	2	3	3	3	1	3	2	3	1	3	3	2	2	5	7	11	8	11	37	1	1	1	1	1	5	1	1	0	1	1	4

Contd...

1	2	3		4	5	6	7	8	9	10	11	12	13		15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
21	Cg	21	11	14	43	5	6	8	9	4	3	9	4	4	3	[illegible]	8	8	9	10	11	8	8	39	1	[illegible]	1	1	1	[illegible]	1	1	1	[illegible]	1	8
22	Cg	22	11	16	30	4	1	9	9	6	4	9	6	6	2	1	3	8	8	8	11	[illegible]	10	38	1	1	[illegible]	1	2	8	1	1	[illegible]	1	1	5
23	Cg	23	11	16	30	4	6	8	10	3	7	6	8	1	3	8	8	0	12	7	11	[illegible]	13	33	1	1	[illegible]	1	8	8	1	1	1	1	1	5
24	Cg	24	11	10	33	4	3	5	4	6	2	5	4	6	7	9	8	9	5	11	14	10	10	40	1	1	1	1	1	5	1	1	2	2	2	8
25	Cg	25	11	16	23	5	3	7	7	8	6	2	1	8	3	3	3	5	8	6	12	10	10	40	2	2	2	1	2	9	2	1	2	0	1	6
26	Cg	26	11	13	15	4	6	6	5	4	6	6	5	3	2	4	8	6	7	8	14	10	12	46	1	1	1	1	1	5	1	1	1	1	1	[illegible]
27	Cg	27	11	10	14	3	1	5	2	4	2	4	4	6	4	6	2	3	2	4	14	10	15	43	2	3	2	1	0	8	1	3	1	1	1	7
28	Cg	28	11	14	16	4	6	8	4	5	3	5	3	4	6	5	4	4	4	9	12	11	10	42	1	3	1	1	1	7	1	3	1	1	1	7
29	Cg	29	11	13	14	4	6	9	4	4	2	6	3	4	2	4	2	5	4	8	12	10	5	35	1	1	1	1	1	5	1	3	1	1	1	7
30	Cg	30	11	13	13	3	4	5	8	6	5	4	4	4	6	4	4	4	5	11	13	10	13	47	1	2	1	2	2	8	2	2	2	1	2	9
31	Cg	31	11	13	13	4	6	3	7	3	5	5	3	5	4	6	4	5	7	7	13	8	6	33	1	1	1	1	1	5	1	1	1	1	1	5
32	Cg	32	11	13	12	4	4	3	3	1	3	5	4	8	5	3	7	6	7	10	14	9	15	48	2	2	1	2	2	9	1	1	1	1	1	5
33	Cg	33	11	16	11	6	4	7	3	4	9	6	8	2	3	7	9	3	7	8	12	10	10	40	2	2	2	1	2	8	2	1	2	1	2	8
34	Cg	34	11	13	11	7	6	5	7	7	6	2	5	3	7	7	8	6	7	8	12	10	10	40	2	2	2	1	0	7	1	1	1	2	2	7
35	Cg	35	11	15	11	5	4	5	8	1	7	5	1	4	6	4	10	6	7	8	14	7	5	34	2	2	1	1	2	8	2	2	2	2	2	10
36	Cg	36	11	15	10	7	6	9	4	2	6	4	4	6	9	7	7	6	7	8	13	10	8	39	2	2	2	1	1	8	2	0	2	2	0	6
37	Cg	37	11	17	10	4	4	5	3	7	6	1	5	4	4	3	7	3	7	9	15	11	5	40	2	2	2	2	1	9	1	3	1	3	3	11
38	Cg	38	11	17	10	5	4	6	3	5	4	2	1	3	5	3	2	5	3	8	11	10	5	34	1	2	2	2	2	9	1	3	1	1	1	7
39	Cg	39	11	15	8	4	6	4	5	1	7	2	5	6	5	5	10	5	4	10	11	12	15	48	1	1	1	1	1	5	1	1	1	1	1	5
40	Cg	40	10	16	9	3	4	6	6	6	7	5	5	5	4	3	5	7	7	10	10	13	3	36	2	2	2	2	2	10	1	1	1	1	2	6

Contd....

1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
41	Cg	41	12	17	45	4	8	6	5	3	3	4	9	9	7	9	7	6	6	11	12	5	8	38	4	4	4	4	3	5	1	3	3	2	4	11
42	Cg	42	12	19	44	6	4	7	5	8	6	5	5	4	3	5	5	6	1	7	12	8	15	43	4	4	4	1	3	6	4	3	3	4	2	10
43	Cg	43	11	17	41	4	4	7	6	4	6	6	[illegible]	4	5	7	3	3	4	9	14	8	9	35	3	3	5	3	1	5	4	2	1	1	1	8
44	Cg	44	12	16	38	3	8	7	6	3	7	3	8	4	3	5	3	7	7	9	11	11	6	37	3	1	1	1	1	4	1	1	1	1	1	5
45	Cg	45	12	18	37	5	4	5	5	5	4	5	8	8	4	4	6	4	6	9	15	5	8	35	3	3	1	1	1	6	1	1	1	1	1	5
46	Cg	46	11	18	35	[illegible]	4	10	5	4	4	8	9	3	1	5	5	[illegible]	5	5	13	11	11	40	1	1	1	1	1	5	1	1	1	1	1	5
47	Cg	47	12	17	35	[illegible]	4	10	5	4	4	8	9	3	1	5	5	7	5	10	13	12	9	41	1	2	[illegible]	2	3	8	1	1	1	1	1	5
48	Cg	48	11	16	34	3	3	7	5	3	7	3	6	4	4	3	5	7	4	11	13	9	6	39	[illegible]	1	1	1	1	5	1	1	1	1	1	5
49	Cg	49	11	16	34	4	3	4	5	3	4	4	5	[illegible]	3	9	7	7	6	8	14	9	13	41	3	1	1	1	1	7	1	1	1	1	1	5
50	Cg	50	12	16	32	4	4	6	5	5	7	4	4	2	4	2	5	3	6	12	13	9	10	43	1	1	1	1	1	5	3	1	1	1	3	6
51	Cg	51	12	21	32	5	6	5	5	[illegible]	5	5	4	9	5	5	4	6	5	3	14	11	6	34	1	1	1	1	1	5	2	3	1	2	2	10
52	Cg	52	12	16	32	6	6	[illegible]	5	5	7	4	5	4	3	7	5	6	5	7	14	9	10	40	1	2	1	1	1	6	2	2	1	2	2	9
53	Cg	53	12	16	32	4	6	4	[illegible]	5	6	3	6	6	4	7	3	5	6	8	13	9	10	40	1	1	1	1	1	5	1	3	1	1	1	7
54	Cg	54	12	17	32	4	4	8	4	2	7	2	6	4	4	7	3	5	7	7	15	9	3	34	1	2	1	2	2	8	2	1	1	1	2	7
55	Cg	55	11	14	31	3	6	7	7	6	7	2	8	6	2	6	3	7	3	7	14	9	6	36	1	1	1	1	1	5	1	3	[illegible]	1	1	7
56	Cg	56	12	16	30	5	6	8	[illegible]	5	7	3	4	6	4	4	2	5	5	10	14	8	11	43	1	2	1	2	2	8	2	2	2	2	2	10
57	Cg	57	12	21	30	4	3	8	5	[illegible]	4	4	5	8	4	4	6	9	5	9	15	12	6	42	3	2	2	1	1	9	2	2	2	2	1	9

Contd....

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
58	Cg 58	13	24	50	5	6	7	7	4	6	4	7	4	6	7	4	7	7	10	14	14	6	44	1	1	1	1	1	5	1	3	1	1	1	12
59	Cg 59	13	20	50	5	4	5	5	4	5	4	9	1	1	1	3	7	1	12	15	10	6	43	1	1	1	1	2	6	1	1	1	1	1	5
60	Cg 60	13	23	47	4	6	7	7	8	7	4	4	7	6	4	3	5	7	10	15	11	6	42	2	2	2	2	2	10	1	1	1	1	1	5
61	Cg 61	13	16	46	4	4	4	6	4	2	1	5	3	5	7	5	4	8	12	15	9	3	39	1	1	1	1	1	5	1	1	1	1	1	5
62	Cg 62	13	17	46	2	6	8	9	3	7	4	7	3	5	5	3	7	1	13	15	14	3	45	1	1	1	1	1	5	1	1	2	1	1	6
63	Cg 63	12	17	45	3	4	8	7	4	5	6	8	2	2	2	4	9	1	13	11	10	3	37	2	2	2	2	2	10	1	1	1	1	1	5
64	Cg 64	13	19	44	5	7	4	6	6	6	4	4	4	3	7	4	5	7	11	14	12	11	48	1	3	1	1	1	7	2	1	1	1	1	6
65	Cg 65	13	16	44	4	6	5	7	4	4	4	5	5	3	4	7	7	7	13	13	14	11	51	2	2	1	2	2	9	1	2	2	2	2	9
66	Cg 66	13	21	43	4	7	8	8	7	5	3	6	4	1	3	5	7	5	11	14	12	5	42	1	1	1	1	1	5	1	1	1	1	1	5
67	Cg 67	13	18	43	5	4	6	7	4	6	4	5	7	3	6	8	6	5	8	12	8	5	33	1	1	1	1	1	5	1	2	1	1	1	6
68	Cg 68	13	16	40	3	4	1	7	2	8	4	4	6	5	10	6	4	10	8	13	2	0	23	1	1	1	1	1	5	1	3	1	1	1	7
69	Cg 69	13	18	39	3	6	5	7	6	7	4	7	4	6	9	4	9	3	10	11	12	10	43	1	1	1	1	1	5	1	1	1	1	1	5
70	Cg 70	10	16	38	4	6	4	7	4	7	2	5	1	5	9	4	7	8	8	15	9	11	43	1	2	2	1	1	7	2	1	1	1	1	6
71	Cg 71	12	16	36	4	4	6	7	10	7	4	4	1	6	7	4	3	7	12	15	9	11	47	2	2	2	2	2	10	1	1	1	1	1	5
72	Cg 72	12	16	38	4	6	4	7	5	6	3	6	8	3	5	4	9	7	10	14	10	11	45	2	2	2	2	2	10	1	1	1	1	1	5
73	Cg 73	13	16	36	5	6	7	7	3	7	5	5	3	4	6	5	10	7	12	15	10	13	50	1	1	1	1	1	5	1	1	0	0	1	3
74	Cg 74	13	17	25	4	6	8	7	6	6	6	8	6	5	3	3	6	4	12	14	12	6	44	2	1	1	1	1	6	1	1	1	1	1	5
75	Cg 75	13	17	25	2	6	6	8	4	7	4	7	5	4	6	3	7	4	9	10	8	6	33	2	2	2	2	2	10	2	2	2	1	1	8
76	Cg 76	13	17	25	4	4	7	5	6	8	4	7	4	3	5	2	6	1	7	12	8	3	30	2	2	1	1	2	8	1	1	1	1	1	5
77	Cg 77	12	19	15	4	6	6	5	6	6	5	9	3	2	4	2	9	1	9	15	9	0	33	1	1	1	1	1	5	1	1	1	1	1	5

Contd...

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
78	Cg 78	13	22	45	6	6	5	6	3	6	6	7	4	1	7	4	6	7	12	11	11	15	49	1	1	1	1	1	5	1	1	1	1	1	5
79	Cg 79	14	18	45	7	6	7	7	3	7	5	5	4	5	9	4	6	6	15	15	15	11	56	1	1	1	1	1	5	1	1	1	1	1	5
80	Cg 80	14	16	45	6	6	5	7	3	7	5	5	4	5	9	6	6	6	13	15	11	15	54	1	1	1	1	1	5	1	1	1	1	1	5
81	Cg 81	14	17	45	6	5	5	7	2	7	6	7	2	5	7	6	4	9	11	15	10	15	51	1	1	1	1	1	5	1	1	1	1	1	5
82	Cg 82	13	19	44	3	4	6	6	3	4	6	5	5	3	6	5	3	7	10	14	13	15	54	1	1	1	1	1	5	1	1	1	1	1	5
83	Cg 83	14	16	44	6	6	5	7	1	7	5	5	4	4	10	6	6	8	13	15	11	15	54	1	1	1	1	1	5	1	1	1	1	1	5
84	Cg 84	13	22	44	6	6	5	9	2	7	6	5	5	4	9	6	6	7	8	15	11	15	49	1	1	1	1	1	5	1	1	1	1	1	5
85	Cg 85	13	15	44	7	6	6	9	2	7	4	4	4	6	10	5	7	10	2	15	11	15	53	1	1	1	1	1	5	1	1	1	1	1	5
86	Cg 86	13	18	43	7	6	5	7	2	8	5	4	4	7	4	8	4	7	13	15	11	15	54	1	2	3	2	1	9	2	2	1	1	1	7
87	Cg 87	14	16	43	5	4	5	5	5	5	4	6	4	3	6	6	5	7	11	14	12	15	52	1	1	1	1	1	5	1	1	1	1	1	5
88	Cg 88	13	18	42	6	6	8	3	2	5	4	7	5	3	7	8	9	6	8	15	7	0	30	2	2	2	2	2	10	2	2	2	2	2	10
89	Cg 89	13	22	41	6	6	7	6	2	7	5	5	4	5	9	6	6	7	9	13	8	0	30	2	2	1	2	1	8	1	1	1	1	1	5
90	Cg 90	14	16	41	4	6	8	5	3	8	4	8	6	5	4	4	4	7	8	15	10	15	48	2	2	1	2	2	9	1	1	1	1	1	5
91	Cg 91	13	19	40	7	6	5	7	2	9	4	4	6	5	7	7	9	8	12	11	9	15	47	2	1	1	1	1	6	1	1	1	1	1	5
92	Cg 92	13	18	39	6	6	5	7	2	7	5	5	4	5	9	6	7	6	6	11	8	5	30	2	2	2	2	2	10	1	1	1	1	1	5
93	Cg 93	13	18	39	7	6	9	5	2	4	4	5	2	4	6	7	7	7	2	11	9	15	47	2	1	1	1	1	6	1	1	1	1	1	5
94	Cg 94	13	20	29	4	2	7	5	2	4	2	2	2	1	5	1	4	7	2	13	7	11	39	2	1	1	2	2	8	2	1	1	2	2	8
95	Cg 95	14	17	37	6	6	5	5	3	7	3	8	4	3	7	5	7	7		15	11	15	52	2	1	2	2	2	9	2	2	2	2	2	10
96	Cg 96	14	16	35	7	7	5	7	2	7	5	5	4	6	9	6	6	7	9	14	8	10	39	2	1	1	2	2	8	1	1	1	2	1	6
97	Cg 97	13	19	35	4	4	5	3	8	6	5	7	5	5	4	4	7	5	9	14	9	15	47	2	2	2	2	2	10	1	2	1	1	1	6

Contd....

354.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
98	Cg 98	14	21	57	6	6	5	2	4	4	6	10	5	3	5	5	5	1	10	14	11	15	50	1	2	2	2	2	9	3	1	1	1	1	8
99	Cg 99	15	21	56	7	6	1	10	10	7	4	2	8	7	7	4	2	10	12	15	9	11	47	2	2	2	2	2	10	2	2	2	2	2	10
100	Cg100	15	17	56	4	7	4	6	6	5	5	5	5	4	6	5	6	6	9	13	10	0	32	1	1	2	1	2	7	3	1	3	1	2	10
101	Cg101	15	17	55	3	7	3	6	4	6	3	3	7	6	10	6	5	6	9	15	11	15	50	1	2	2	1	2	8	3	3	3	1	1	11
102	Cg102	15	20	54	4	7	4	6	4	6	5	7	7	6	9	5	7	4	14	13	10	15	52	1	1	1	1	1	5	2	1	1	1	1	6
103	Cg103	15	16	54	5	4	3	7	5	4	3	2	10	5	10	4	3	5	13	14	11	15	53	1	1	1	1	1	5	1	3	1	1	1	7
104	Cg104	15	16	52	4	4	10	7	6	7	4	4	9	7	9	2	5	5	14	15	10	15	54	1	2	2	1	1	7	2	2	2	2	1	9
105	Cg105	15	17	49	3	4	5	5	6	6	1	6	2	6	3	7	6	1	12	14	11	15	50	2	1	1	1	2	7	1	3	1	1	1	7
106	Cg106	15	20	48	2	4	1	6	6	3	3	4	4	6	9	4	2	3	9	15	10	10	44	1	2	2	1	2	8	2	2	2	2	2	10
107	Cg107	15	19	48	4	6	7	7	6	7	4	7	4	2	9	5	6	7	12	15	15	15	57	1	2	2	2	2	9	2	2	2	2	2	10
108	Cg108	15	16	48	4	4	5	8	6	6	3	5	4	6	9	6	5	6	9	14	12	10	45	1	0	1	1	2	5	3	1	1	1	1	7
109	Cg109	15	16	47	4	6	7	7	8	7	4	4	7	6	4	3	5	7	8	12	5	6	31	1	3	2	2	2	10	2	2	2	2	2	10
110	Cg110	15	17	47	7	3	5	6	4	5	4	5	5	6	5	5	7	5	14	13	12	10	49	2	2	2	2	2	10	2	2	1	2	2	9
111	Cg111	15	20	46	2	4	1	6	6	3	3	4	4	6	9	4	2	3	12	13	9	11	45	1	1	1	1	1	5	1	2	2	1	1	7
112	Cg112	14	19	46	5	6	5	6	4	5	2	5	5	6	7	4	2	6	11	14	11	10	46	2	2	2	0	0	6	3	1	3	3	4	14
113	Cg113	15	19	46	6	3	5	7	5	6	3	7	8	7	9	6	6	5	14	15	12	3	44	2	1	1	1	1	6	1	1	1	1	1	5
114	Cg114	15	17	46	5	6	5	4	6	4	6	5	5	4	3	4	7	3	10	14	7	15	46	1	2	2	1	2	8	2	2	2	2	2	10
115	Cg115	15	16	46	3	4	5	7	4	8	4	4	6	5	10	6	4	10	10	13	9	8	40	2	2	2	2	2	10	2	2	2	3	1	17

[illegible] 1

						H.S.P.Q.														[illegible]					[illegible]						I Trial						II Trial						III Trial						[illegible]					
[illegible]	[illegible]	[illegible]	Age	[illegible]	[illegible]	A	B	C	D	E	F	G	H	I	J	O	Q_2	Q_3	Q_4	1	2	3	4	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total
[illegible]	[illegible]	[illegible]	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
[illegible]	[illegible]	[illegible]	10	17	34	6	3	4	6	7	2	5	5	4	4	4	6	6	7	8	15	9	11	40	1	1	1	3	3	9	5	6	6	7	6	30	6	14	8	7	3	28	7	6	5	5	6	27	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	10	17	34	7	3	4	7	3	4	4	3	3	2	8	7	4	8	4	11	10	13	40	1	1	1	1	2	6	7	10	10	8	8	40	6	4	5	4	6	38	8	11	13	18	13	58	1	1	1	1	1	6
[illegible]	[illegible]	[illegible]	10	16	34	5	3	4	8	4	2	1	5	2	2	3	4	3	7	11	13	8	10	40	1	3	1	3	3	11	7	6	6	4	7	30	4	10	13	10	6	40	7	8	5	5	6	38	1	6	1	3	7	8
[illegible]	[illegible]	[illegible]	10	17	34	6	5	4	6	8	6	5	5	7	3	4	7	3	4	9	13	7	11	39	2	3	1	1	1	8	6	10	8	5	6	35	6	11	13	14	8	56	9	11	13	14	9	56	2	7	2	3	3	10
[illegible]	[illegible]	[illegible]	10	16	34	6	4	2	6	4	8	4	4	1	3	5	4	2	4	10	14	9	10	43	1	1	1	3	1	7	6	10	7	6	6	35	7	8	11	7	4	37	3	6	9	4	4	31	2	2	2	1	1	10
[illegible]	[illegible]	6	9	22	33	5	3	6	8	4	4	5	4	3	4	4	8	2	5	7	15	9	15	46	1	1	1	3	2	8	6	11	12	11	9	51	8	11	12	14	7	51	8	11	8	6	5	38	1	2	2	3	1	10
[illegible]	[illegible]	7	10	19	33	5	4	5	4	5	2	4	7	6	4	6	6	4	5	10	11	10	6	37	1	1	1	3	3	9	8	11	8	11	7	40	7	4	7	7	4	34	8	12	7	11	9	48	3	2	3	2	3	10
[illegible]	[illegible]	8	10	22	33	5	5	4	4	5	4	2	6	5	3	6	6	4	5	13	13	5	10	41	2	1	1	0	2	6	8	8	7	9	6	36	7	4	7	7	4	34	8	8	8	10	7	43	1	2	1	2	2	9
[illegible]	[illegible]	9	10	17	33	6	5	4	6	4	6	4	3	7	2	6	6	4	6	12	12	8	10	42	1	3	1	1	1	7	7	5	10	9	7	42	5	9	12	7	6	39	7	10	10	11	12	50	1	3	1	1	1	9
[illegible]	[illegible]	10	9	17	32	6	4	7	6	4	3	4	5	5	1	2	6	5	4	9	9	10	3	31	1	1	1	3	1	7	7	10	11	13	10	55	6	11	14	9	9	52	5	6	8	9	6	34	1	1	3	3	3	10
[illegible]	[illegible]	11	10	18	32	5	5	5	5	3	4	4	5	4	3	4	6	5	5	9	13	10	11	43	1	1	1	1	1	5	8	11	13	15	11	58	8	11	14	9	3	45	7	11	14	15	12	59	1	2	2	1	1	8
[illegible]	[illegible]	12	10	21	32	5	5	4	5	6	3	4	5	8	3	6	6	6	5	10	12	11	15	48	1	1	1	1	1	5	6	10	10	9	4	41	4	5	13	11	5	30	8	9	13	11	9	50	1	2	1	2	2	9
[illegible]	[illegible]	13	10	17	31	5	4	4	4	4	6	4	3	5	1	~~8~~	~~4~~	~~4~~	~~4~~	~~8~~	~~14~~	~~5~~	~~10~~	~~40~~	1	1	0	1	1	4	6	7	6	6	7	34	3	10	7	8	4	32	9	11	8	9	6	41	1	1	1	1	1	5
[illegible]	[illegible]	14	10	18	31	7	4	4	6	5	4	5	5	4	3	2	7	3	4	8	12	10	15	45	1	1	1	1	1	5	7	6	13	8	8	42	5	6	13	5	4	33	4	4	6	6	6	26	2	2	2	1	2	9
[illegible]	[illegible]	15	10	16	31	7	3	5	5	6	5	5	2	5	4	5	4	6	5	7	13	10	11	40	1	1	1	0	1	4	8	11	5	8	8	40	7	10	13	13	4	47	7	11	10	7	4	39	1	1	3	3	1	9
[illegible]	[illegible]	16	10	18	30	5	5	4	7	5	4	1	5	2	2	7	8	4	8	10	12	11	15	48	1	1	1	3	3	9	8	11	13	14	12	58	6	11	6	15	6	44	7	10	6	5	5	33	1	1	1	1	1	5
17	[illegible]	17	10	21	29	6	5	4	7	5	4	4	4	4	4	4	6	2	4	8	11	9	11	39	1	1	1	1	1	5	8	11	13	11	9	52	7	12	14	6	8	47	8	11	13	9	10	52	1	2	2	1	1	7
18	[illegible]	18	9	20	29	5	2	4	8	3	6	4	1	5	2	3	7	6	5	10	15	10	10	45	1	1	1	3	3	9	8	12	13	13	12	58	5	11	14	10	7	47	6	6	6	6	8	30	1	1	1	3	1	7
19	[illegible]	19	10	[illegible]	[illegible]	6	3	8	5	6	6	4	5	5	3	6	6	6	6	6	10	6	15	37	1	1	1	1	1	5	7	10	13	11	8	49	7	10	12	7	8	44	7	12	7	10	8	44	1	1	1	2	3	8
20	[illegible]	20	10	15	27	5	5	4	4	5	4	3	6	5	3	6	6	6	5	8	12	10	6	36	1	1	1	1	1	5	6	8	9	9	4	36	6	4	7	5	5	27	9	8	10	9	8	43	1	2	1	2	1	8

Contd....

356.

Contd.....

Contd......

[illegible]	[illegible]	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
[illegible]	[illegible]	12	20	32	5	5	6	4	3	6	5	6	5	4	6	5	7	5	9	14	12	13	46	2	3	3	3	3	12	8	11	14	12	11	57	8	11	13	14	13	58	8	11	16	14	8	58	1	2	2	2	2	9
[illegible]	[illegible]	13	17	32	4	3	3	6	5	8	4	3	8	5	7	3	4	9	14	15	9	8	46	3	2	3	3	3	9	9	10	14	14	12	64	8	14	10	10	10	46	8	11	12	10	11	51	2	2	2	2	2	10
[illegible]	[illegible]	11	20	30	6	4	8	4	2	3	7	7	5	6	4	4	7	4	10	12	12	13	46	2	1	2	2	2	12	8	8	10	11	7	38	8	7	9	11	5	40	7	10	9	14	8	48	2	2	2	2	2	10
[illegible]	[illegible]	12	21	48	4	4	3	6	1	6	5	1	6	4	6	7	3	8	12	13	11	6	42	3	1	1	1	1	5	8	7	9	10	7	30	8	5	9	11	6	35	8	9	10	13	8	48	1	1	1	1	1	6
[illegible]	[illegible]	12	16	48	6	4	5	5	7	6	6	4	5	7	3	6	6	5	9	12	6	6	33	2	2	2	2	2	10	7	5	6	16	6	36	8	11	14	13	11	50	7	6	11	16	10	46	2	2	2	2	2	10
[illegible]	[illegible]	13	17	40	7	3	9	5	6	6	7	9	7	4	3	2	8	4	13	14	6	6	39	2	2	2	2	2	10	8	10	14	12	11	55	8	11	13	14	8	54	8	12	15	11	8	55	2	2	2	2	2	10
[illegible]	[illegible]	13	22	38	7	7	4	7	4	4	4	6	7	2	8	3	6	6	15	15	15	13	58	2	2	2	3	2	11	9	13	15	13	11	61	6	8	10	10	11	46	8	14	18	16	13	70	2	2	2	2	2	10
[illegible]	[illegible]	10	23	47	7	4	10	6	7	3	5	6	5	1	2	3	7	3	12	15	15	0	47	2	2	2	2	2	10	7	9	10	11	11	48	10	11	10	14	11	56	6	13	17	18	13	65	2	2	2	2	2	10
[illegible]	[illegible]	12	18	46	3	7	5	4	4	4	7	6	3	4	6	6	7	5	11	15	13	1	39	1	1	1	1	1	5	8	9	14	13	13	55	7	12	13	13	10	58	7	10	13	13	10	53	1	1	1	1	1	5
[illegible]	[illegible]	13	19	46	5	5	8	7	7	7	2	7	1	3	7	4	2	5	10	15	11	10	46	2	1	1	1	1	6	8	9	20	10	9	46	8	11	15	10	10	54	10	14	18	12	14	68	2	2	2	2	2	10
[illegible]	71	13	20	46	9	3	2	10	7	5	2	8	5	9	8	9	1	8	13	12	10	3	38	1	1	1	1	1	5	8	11	13	10	8	50	6	11	14	11	8	52	10	12	18	18	14	72	2	2	2	2	2	10
[illegible]	72	13	17	46	5	3	5	10	5	6	6	5	6	7	4	5	2	7	9	10	8	13	40	1	1	1	1	1	5	8	10	13	10	5	46	7	11	15	13	10	56	8	11	11	10	11	51	2	2	2	2	2	10
[illegible]	73	12	21	44	5	5	5	5	5	6	4	6	5	5	6	4	6	6	13	13	12	8	46	1	1	1	1	1	5	7	9	12	10	6	44	7	8	13	14	11	53	8	14	17	11	9	59	2	2	2	2	2	10
[illegible]	74	12	22	44	5	5	5	5	5	6	6	6	5	5	4	4	8	4	11	13	10	8	42	1	1	1	1	1	5	6	9	5	10	8	38	7	11	10	11	8	42	7	14	18	10	8	57	2	1	1	1	1	6
[illegible]	75	13	21	44	6	6	6	3	3	7	6	5	3	5	5	7	7	8	11	15	9	6	41	1	1	1	1	1	5	7	9	7	10	8	41	8	11	10	15	8	56	7	11	14	15	10	57	2	2	2	2	2	10
[illegible]	76	10	20	46	7	3	5	7	6	4	6	5	2	7	4	5	6	4	11	9	10	6	36	1	1	2	2	2	8	8	11	14	12	11	56	8	11	14	11	12	56	9	14	18	16	8	65	1	1	1	1	1	5
[illegible]	77	13	17	43	6	3	3	5	2	6	5	7	6	7	7	5	3	5	10	9	7	6	32	1	2	2	2	0	7	9	11	14	14	9	55	8	11	14	10	10	53	9	12	14	14	10	59	2	2	2	2	2	10

Contd.....

[illegible]	[illegible]	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
[illegible]	[illegible]	[illegible]	22	30	7	3	5	6	7	6	7	7	5	3	4	6	7	6	13	12	13	6	44	2	3	2	1	2	10	8	15	10	13	10	56	8	12	10	10	10	50	9	14	18	16	12	69	2	2	1	1	4	10
[illegible]	[illegible]	[illegible]	18	35	2	7	6	3	7	8	4	5	5	8	4	3	8	6	11	13	14	16	54	2	1	2	5	2	12	7	10	15	16	11	[illegible]	5	11	12	14	9	51	10	16	13	17	14	70	2	2	2	2	4	12
[illegible]	[illegible]	[illegible]	31	36	4	9	9	1	5	9	8	7	3	5	4	3	7	2	12	10	12	18	52	3	2	3	1	1	10	8	9	13	11	11	[illegible]	10	14	18	18	14	74	10	16	18	18	12	74	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	30	38	6	5	4	4	2	3	4	6	5	7	2	6	8	5	15	14	14	13	56	1	1	2	1	1	6	7	9	14	14	10	54	7	10	14	6	11	48	8	11	14	14	11	58	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	30	35	9	7	9	1	5	7	8	9	4	5	6	3	4	1	12	15	15	15	57	2	2	2	2	2	10	8	9	13	10	8	48	7	9	18	10	9	53	10	14	18	18	14	74	2	2	2	1	2	9
[illegible]	[illegible]	[illegible]	30	35	6	8	6	3	8	6	4	7	5	5	6	3	6	7	16	14	12	13	55	2	2	2	2	2	10	7	10	11	10	11	49	8	14	10	14	10	56	7	12	16	18	14	67	2	2	2	2	3	11
[illegible]	[illegible]	[illegible]	30	34	3	3	8	3	6	2	6	7	5	7	4	6	6	4	12	13	13	6	44	2	3	3	1	0	9	7	11	14	14	9	55	9	14	18	10	9	60	10	16	16	18	14	74	2	2	2	2	4	12
[illegible]	[illegible]	[illegible]	17	32	4	3	9	7	5	4	5	6	5	4	6	5	4	9	12	15	9	6	42	2	2	2	2	2	10	8	8	10	10	8	44	10	14	18	18	16	76	10	14	16	16	14	70	2	1	2	2	4	11
[illegible]	[illegible]	[illegible]	30	33	9	8	7	7	7	8	6	4	7	5	6	5	6	6	9	14	6	18	47	3	3	1	1	1	9	7	10	14	10	7	48	7	9	18	10	9	53	8	11	14	14	11	58	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	28	30	1	5	6	9	5	5	4	5	4	7	6	6	6	8	14	14	10	18	56	2	2	1	2	2	9	8	9	11	12	7	47	10	12	14	11	11	58	6	14	18	18	14	70	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	18	46	6	3	4	6	4	2	3	5	2	5	5	6	6	5	12	13	8	7	40	0	1	2	2	2	7	9	12	14	11	11	57	8	12	14	15	10	59	8	11	11	11	9	50	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	20	48	8	4	7	5	5	8	8	8	3	7	6	2	5	3	13	15	13	15	56	2	2	2	2	2	10	8	11	14	14	11	58	9	11	14	14	11	59	10	16	13	17	14	70	2	2	2	2	4	12
[illegible]	[illegible]	[illegible]	15	44	7	7	6	7	7	1	4	4	2	2	6	4	6	7	12	15	13	15	55	2	2	2	2	2	10	6	10	14	10	11	51	9	14	14	12	11	60	10	14	18	18	14	74	2	2	2	2	4	12
[illegible]	[illegible]	[illegible]	20	44	7	8	4	5	5	4	5	9	7	3	5	6	5	5	11	15	11	10	47	1	1	2	1	1	6	8	12	13	10	11	54	8	11	14	14	10	57	8	11	12	14	8	53	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	10	43	[illegible]	[illegible]	3	8	5	9	4	7	1	3	3	5	6	8	14	15	11	15	55	2	1	1	2	0	6	8	11	13	11	10	53	6	8	11	12	8	45	8	8	10	10	8	44	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	21	41	[illegible]	5	[illegible]	6	5	4	5	6	5	5	5	1	7	4	11	15	9	15	50	1	1	1	1	1	5	7	10	13	12	7	49	8	11	14	15	10	58	8	14	13	18	12	65	2	3	2	2	2	11
[illegible]	[illegible]	[illegible]	22	40	[illegible]	[illegible]	[illegible]	6	5	6	5	6	5	5	5	1	7	4	12	15	11	10	48	2	1	2	2	0	7	8	10	14	13	11	56	7	11	14	12	13	57	8	12	14	12	9	55	2	2	2	2	2	10

360.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	S.S.S.														[illegible]					Pre Test						I Testing						II Testing						III Testing						Post Test					
					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
[illegible]	[illegible]	[illegible]	14	16	5	3	8	2	4	8	1	4	3	5	1	3	1	5	6	13	8	15	42	1	1	1	1	1	5	6	10	7	8	7	38	3	4	5	3	4	19	3	4	5	5	4	21	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	20	26	4	7	8	6	3	3	4	5	2	3	6	3	3	6	9	9	3	15	36	1	1	1	1	1	5	8	8	6	10	8	40	3	6	6	9	6	30	3	4	5	5	4	21	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	26	26	7	4	3	7	4	4	3	6	2	6	7	3	3	7	7	12	10	15	44	1	1	1	1	2	6	9	9	5	8	3	34	3	4	5	5	4	21	6	6	5	5	8	30	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	18	20	5	4	5	9	4	10	4	5	2	2	7	4	3	5	3	10	9	10	32	1	1	1	1	1	5	6	11	10	8	5	40	5	6	8	6	5	30	6	6	6	6	5	29	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	21	30	5	3	5	5	7	3	3	6	5	4	6	5	3	4	6	4	7	14	31	1	1	1	1	1	5	4	6	5	8	6	29	3	4	5	5	4	21	3	4	4	7	4	22	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	22	30	1	4	7	5	3	6	1	5	4	5	9	9	4	4	6	11	9	10	36	1	1	3	1	1	7	5	8	7	5	4	29	5	8	5	6	6	30	5	8	5	5	4	27	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	20	15	4	2	8	7	3	7	2	3	3	1	3	6	5	5	8	9	7	15	39	2	1	2	3	1	9	5	11	7	7	5	35	2	4	5	5	5	21	5	4	5	4	6	24	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	22	15	7	6	5	4	2	7	1	3	4	6	7	5	2	3	7	12	9	11	39	2	2	1	1	1	7	5	8	5	8	10	36	7	8	5	7	8	35	4	8	6	5	6	29	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	20	16	3	6	5	6	2	4	1	7	4	4	7	8	5	4	9	12	9	15	45	1	1	1	1	1	5	7	10	11	7	5	40	3	6	5	5	6	25	3	4	5	5	4	21	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	17	14	6	4	5	3	6	8	4	6	6	1	5	5	3	7	6	13	6	4	29	1	1	1	1	1	5	4	8	9	6	4	31	3	9	7	5	6	30	6	9	5	7	6	33	1	3	1	3	1	9
[illegible]	[illegible]	[illegible]	14	16	7	3	8	6	9	3	3	7	4	1	7	9	3	8	2	9	2	15	28	1	1	1	1	1	5	4	6	5	5	4	24	5	10	9	7	6	37	7	12	5	8	8	40	1	2	1	2	2	8
[illegible]	[illegible]	[illegible]	16	13	5	3	5	7	7	7	4	4	2	6	9	2	9	9	6	10	7	15	38	1	1	1	1	1	5	6	11	13	7	9	46	3	4	5	6	6	24	3	4	5	6	4	22	1	3	1	1	1	7
[illegible]	[illegible]	[illegible]	19	13	5	4	4	5	5	3	3	7	5	1	6	4	3	7	4	11	7	13	35	1	1	1	1	1	5	7	9	13	8	5	42	5	10	5	5	5	30	5	10	9	5	4	33	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	18	13	3	4	4	6	5	6	8	5	8	5	5	10	4	5	7	12	7	15	41	1	1	1	1	1	5	7	10	11	7	5	40	3	4	5	5	4	21	5	6	5	5	4	25	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	12	12	5	2	3	6	1	3	2	1	5	4	5	10	5	7	7	11	8	11	37	3	1	1	1	0	6	4	8	7	4	5	28	4	6	6	4	5	25	4	5	4	7	3	23	1	3	1	0	0	5
[illegible]	[illegible]	[illegible]	15	12	8	7	6	7	1	7	6	3	4	6	5	1	2	7	6	7	5	10	28	1	3	1	1	1	7	5	8	7	7	4	31	5	8	11	5	5	34	5	10	10	5	4	34	1	3	3	1	1	9
[illegible]	[illegible]	[illegible]	15	12	3	4	4	5	3	7	2	2	6	6	6	2	2	6	9	12	8	6	35	1	1	1	3	3	9	2	5	5	7	6	25	4	6	2	9	5	26	4	8	9	9	7	37	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	18	11	5	6	6	3	8	5	4	5	5	8	9	2	5	8	8	12	8	15	43	1	1	1	1	1	5	7	10	9	5	7	38	6	8	6	7	8	35	3	10	7	11	13	44	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	22	10	3	2	2	5	4	7	4	4	4	7	6	5	3	5	7	12	8	15	42	1	1	1	1	1	5	3	10	9	5	7	34	3	5	6	9	4	27	3	4	9	7	4	27	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	19	9	2	6	2	8	7	7	4	1	5	7	7	7	4	7	8	12	10	10	40	1	1	1	3	3	9	3	10	7	7	5	32	4	6	5	5	6	29	5	6	6	5	4	26	1	3	3	3	1	11

Contd......

[illegible]	[illegible]	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	13	46	6	8	4	3	6	7	3	5	6	6	3	9	5	8	10	15	9	9	34	1	1	2	1	3	10	1	1	14	8	8	38	1	11	14	6	4	34	9	9	4	2	9	38	5	4	1	3	4	5
[illegible]	[illegible]	[illegible]	17	45	3	8	6	6	5	5	4	5	6	6	3	5	3	5	12	15	1	6	38	1	1	1	1	1	1	1	6	13	1	6	36	1	10	13	3	9	36	7	10	1	5	8	39	7	1	7	4	4	11
[illegible]	[illegible]	[illegible]	10	42	3	8	6	7	5	6	6	7	4	3	7	3	3	9	4	15	9	9	36	1	1	1	1	1	6	1	9	14	1	1	38	1	10	13	5	10	45		10	4	8	8	43	1	6	4	1	1	5
[illegible]	[illegible]	[illegible]	14	40	9	7	5	5	6	6	6	1	7	3	5	4	5	3	9	14	10	9	33	1	1	1	1	1	10	4	10	10	5	8	40	1	9	12	6	9	43	.	4	7	10	6	36	4	7	1	3	6	11
[illegible]	[illegible]	[illegible]	20	41	3	9	4	5	3	3	5	6	7	3	3	4	4	6	4	14	8	8	34	1	1	1	0	1	1	9	10	4	4	5	35	3	8	1	5	1	43	2	1	5	4	4	13	1	3	4	6	3	1
[illegible]	[illegible]	[illegible]	17	14	4	4	3	6	7	6	6	1	4	6	4	3	7	3	9	12	7	5	32	1	1	1	1	1	5	7	8	7	6	5	34	4	10	7	5	6	35	6	3	6	8	6	33	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	14	29	4	4	7	2	7	2	3	6	5	10	3	2	6	5	9	11	9	8	30	1	1	1	1	1	6	7	6	7	6	8	38	5	13	11	11	11	38	6	8	8	1	5	30	1	5	1	1	1	6
[illegible]	[illegible]	[illegible]	16	35	3	4	5	8	3	6	4	4	7	2	6	8	3	5	5	15	10	6	36	2	3	2	1	1	1	7	10	8	8	7	39	4	10	14	14	7	36	5	10	1	9	5	35	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	14	34	3	6	5	7	3	4	4	4	7	4	4	3	3	5	9	12	9	8	30	1	1	1	1	1	5	2	6	7	1	5	36	5	8	9	5	8	35	5	8	9	5	5	36	1	1	1	1	1	7
[illegible]	[illegible]	[illegible]	19	28	6	7	6	3	4	2	3	2	6	1	5	2	6	4	3	13	5	8	29	2	1	1	1	1	8	9	10	11	7	5	40	4	8	9	5	4	39	5	7	6	8	5	38	1	3	3	2	4	10
[illegible]	[illegible]	[illegible]	20	29	3	6	4	5	6	3	3	2	5	3	5	4	3	4	5	15	10	10	40	1	1	1	1	1	5	7	9	7	5	6	34	8	9	12	6	7	41	6	7	7	9	4	39	1	1	1	1	8	4
[illegible]	[illegible]	[illegible]	14	28	6	3	4	5	6	3	3	1	4	3	7	2	4	5	10	11	8	5	34	1	1	1	1	1	5	5	8	9	7	5	34	5	8	5	7	9	38	7	10	7	10	5	39	1	1	1	1	1	9
[illegible]	[illegible]	[illegible]	16	20	6	7	6	3	6	3	2	2	4	3	3	2	7	4	9	14	9	0	32	1	1	1	1	1	5	5	10	7	5	5	33	5	4	7	5	4	29	5	4	7	6	8	30	3	3	3	1	4	14
[illegible]	[illegible]	[illegible]	17	25	1	6	6	3	7	3	2	1	5	3	5	3	3	2	10	12	[illegible]	0	31	1	1	1	1	1	5	7	10	7	7	5	36	4	6	11	9	6	35	7	10	6	8	7	38	1	3	2	1	1	9
[illegible]	[illegible]	[illegible]	15	29	6	6	5	3	6	3	6	3	6	2	3	4	4	7	4	13	9	0	26	2	2	2	2	2	10	5	12	12	10	6	45	8	11	9	8	7	43	6	7	5	8	7	33	2	3	3	3	2	13
[illegible]	[illegible]	[illegible]	15	28	5	6	8	4	4	7	7	1	5	1	5	2	5	4	12	15	9	11	47	1	1	1	1	1	5	8	10	9	8	6	41	3	8	5	5	4	23	6	7	6	8	6	33	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	16	19	4	4	4	8	3	3	5	1	7	2	9	2	5	5	3	15	8	0	26	2	2	1	2	1	8	7	9	12	6	6	40	5	8	5	5	4	27	7	8	7	5	6	33	1	3	1	3	0	8
[illegible]	[illegible]	[illegible]	20	20	5	6	8	4	4	2	2	1	5	2	5	2	7	3	4	4	3	0	11	1	1	1	1	1	5	8	10	9	7	6	40	5	4	9	9	3	30	6	7	5	6	6	28	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	14	19	6	7	6	4	2	4	2	1	5	2	5	2	6	5	4	14	9	0	27	1	2	2	1	1	7	7	8	4	5	6	30	0	9	8	6	8	31	3	6	5	6	6	26	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	14	15	3	1	5	3	7	3	4	1	6	2	4	2	3	3	5	13	7	0	25	1	1	1	1	1	5	7	9	9	7	6	36	7	8	7	5	9	31	3	5	5	5	5	23	3	1	2	2	1	9

Contd......

362.

[illegible]	[illegible]	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
[illegible]	[illegible]	17	14	46	5	7	5	6	6	6	4	5	3	4	3	6	8	8	13	13	14	10	49	1	1	1	1	1	1	1	8	5	1	8	37	5	6	8	4	8	16	8	14	5	4	6	39		1	5	4	1	8
[illegible]	[illegible]	12	20	44	3	10	2	5	1	7	2	5	3	4	3	5	6	3	11	13	13	15	52	1	1	1	1	1	5	9	10	9	4	8	16	7	12	6	6	3	37	9	14	14	[illegible]	8	34		1	1	1	1	11
[illegible]	[illegible]	[illegible]	15	44	3	4	4	5	3	6	3	4	6	7	5	9	5	5	13	15	12	15	54	1	1	1	1	1	5	5	10	10	7	6	26	9	11	3	1	4	35	9	14	1	5	6	31	4	1	1	1	4	8
[illegible]	[illegible]	17	20	44	5	6	5	4	4	5	4	4	4	5	4	6	4	6	12	14	10	10	46	1	1	1	1	1	5	9	10	5	3	3	14	5	4	2	5	4	35	8	14	1	5	3	35	1	1	1	1	5	9
[illegible]	[illegible]	12	15	44	4	4	3	5	4	7	4	5	5	2	5	6	4	7	12	15	11	15	13	1	1	1	1	1	5	9	7	6	1	6	27	3	12	4	11	6	42	7	16	1	1	6	31	3	1	1	1	1	9
[illegible]	[illegible]	12	14	46	3	4	4	7	4	6	4	5	5	4	3	7	7	5	9	15	11	18	45	1	1	1	1	1	9	6	8	8	3	5	30	3	10	11	6	10	47	7	16	7	5	4	31	3	6	5	2	1	7
[illegible]	[illegible]	12	25	44	4	4	5	6	4	6	3	5	7	4	6	7	7	5	8	15	9	15	47	1	2	1	1	1	5	5	7	7	7	4	30	7	12	5	5	4	33	3	5	7	7	4	25	2	1	1	1	5	10
[illegible]	[illegible]	[illegible]	25	43	4	6	5	7	4	4	4	5	5	3	4	3	7	7	10	13	12	15	51	1	1	1	2	1	5	9	10	6	5	4	32	5	8	7	8	7	36	4	12	4	7	4	35	1	1	1	1	1	9
[illegible]	[illegible]	12	27	43	3	7	3	5	5	4	4	5	4	1	6	4	5	5	12	15	11	15	50	1	1	1	2	1	5	7	10	13	9	4	43	7	6	4	9	6	39	7	6	5	5	4	29	3	1	2	1	1	8
[illegible]	[illegible]	[illegible]	10	42	6	7	5	5	4	7	3	5	2	3	7	9	5	6	9	15	11	15	50	1	1	1	1	1	5	7	8	9	6	4	34	3	6	5	5	4	23	7	10	5	5	4	31	3	3	1	1	1	11
[illegible]	[illegible]	12	19	47	3	7	3	9	4	4	4	3	6	5	7	4	5	7	11	15	20	15	51	1	1	1	1	1	5	6	9	7	5	4	31	6	11	7	11	4	39	8	10	5	5	4	32	1	1	1	1	1	5
[illegible]	[illegible]	11	14	39	3	6	1	5	4	6	4	5	7	4	7	7	7	5	11	15	11	0	57	1	1	1	1	1	5	5	7	7	7	4	30	7	10	11	9	4	41	7	10	5	5	4	31	3	1	1	1	1	7
[illegible]	[illegible]	12	20	30	3	6	5	7	6	6	1	5	5	5	7	7	1	1	6	13	8	0	29	1	1	1	1	1	5	5	7	6	5	4	27	7	6	11	7	4	34	7	6	13	5	6	37	3	1	3	1	1	9
[illegible]	[illegible]	12	17	30	3	6	3	6	4	7	1	3	5	1	3	8	5	5	11	12	12	11	46	1	1	1	1	1	5	5	10	11	7	7	40	5	4	5	5	4	22	5	10	7	5	4	31	1	1	1	1	1	5
[illegible]	[illegible]	12	17	36	4	4	3	5	3	6	3	4	2	5	6	5	5	7	11	15	10	0	42	1	1	1	1	1	5	7	11	9	5	7	39	7	8	9	7	5	36	5	6	5	5	4	25	1	1	1	1	1	5
[illegible]	[illegible]	12	14	36	3	4	4	5	4	5	3	3	4	1	4	7	6	5	11	15	9	19	50	1	1	1	1	1	5	7	8	5	7	4	31	5	8	5	7	4	29	7	10	5	5	4	31	3	3	1	1	1	9
[illegible]	[illegible]	[illegible]	17	34	5	7	5	6	5	6	2	5	5	3	6	9	5	5	10	13	9	15	47	1	1	1	1	1	5	7	7	5	5	4	28	5	8	7	5	4	29	7	10	5	5	4	31	3	3	3	3	1	13
[illegible]	[illegible]	12	16	31	3	7	5	7	6	6	2	4	4	5	6	9	7	6	11	14	13	0	38	2	1	1	1	1	6	7	12	9	11	4	43	7	10	8	5	4	34	7	10	11	5	4	37	1	1	1	1	1	5

Contd....

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
[illegible]	[illegible]	[illegible]	19	[illegible]	7	4	5	5	4	4	1	4	1	6	5	5	4	4	11	13	11	5	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	1	4	5	5	5	[illegible]	3	5	5	7	4	[illegible]	4	4	4	5	4	[illegible]	-	1	[illegible]	1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	17	[illegible]	4	4	4	4	4	3	1	5	5	5	[illegible]	5	4	8	10	10	8	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	4	4	7	5	4	[illegible]	[illegible]	4	4	7	4	[illegible]	4	1	14	4	4	[illegible]	[illegible]	1	1	1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	5	5	7	2	4	3	4	2	4	5	7	5	5	10	12	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	5	11	5	4	[illegible]	4	6	8	4	[illegible]	[illegible]	4	[illegible]	13	4	4	[illegible]	1	1	1	1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6	4	5	5	4	9	5	3	3	1	9	1	4	10	11	15	10	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	1	6	5	7	5	[illegible]	4	4	5	5	4	[illegible]	6	6	7	10	4	[illegible]	1	1	1	1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7	4	5	5	5	[illegible]	2	4	4	3	7	3	5	7	13	[illegible]	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	5	5	5	4	[illegible]	1	10	7	5	4	[illegible]	5	8	16	7	4	[illegible]	1	1	1	1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	3	3	7	5	7	1	4	10	4	7	5	3	[illegible]	8	14	4	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	7	10	5	4	4	[illegible]	[illegible]	10	4	8	4	[illegible]	5	8	15	11	8	[illegible]	1	1	1	1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	4	5	7	3	6	4	4	2	5	6	2	7	8	10	[illegible]	10	5	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	3	6	7	5	4	[illegible]	5	4	7	7	6	[illegible]	3	6	6	7	8	[illegible]	1	1	1	1	4	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	35	4	3	5	7	5	6	2	4	5	8	7	8	3	5	9	15	8	5	37	[illegible]	2	2	1	2	8	3	4	5	5	4	21	7	6	3	7	4	33	5	6	9	7	4	[illegible]	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	[illegible]	36	3	4	4	6	5	5	3	5	2	2	7	4	3	5	9	13	11	5	38	[illegible]	[illegible]	[illegible]	1	1	8	[illegible]	6	9	5	4	[illegible]	8	8	[illegible]	7	7	[illegible]	9	10	12	13	[illegible]	[illegible]	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	[illegible]	28	3	3	3	7	4	4	3	5	5	2	7	4	7	4	12	15	11	3	41	2	1	1	1	1	6	3	4	5	5	4	21	5	10	10	10	4	[illegible]	3	11	16	10	9	[illegible]	[illegible]	1	1	1	1	5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	4	5	7	4	6	2	4	6	4	4	5	7	7	10	15	11	9	45	2	2	2	2	2	10	7	4	5	5	4	25	5	10	11	6	8	40	8	11	13	12	6	[illegible]	[illegible]	1	1	1	4	8
[illegible]	[illegible]	[illegible]	[illegible]	27	3	4	2	6	5	5	4	4	1	7	5	5	4	9	12	15	12	3	42	2	2	2	2	2	10	3	4	5	5	4	21	3	4	5	5	6	23	3	8	9	7	9	37	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	18	27	4	3	5	6	4	6	3	4	4	2	4	7	6	7	11	12	11	3	37	2	1	1	1	1	6	4	10	11	5	4	34	5	10	9	5	6	35	3	12	14	8	4	[illegible]	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	16	27	3	4	3	5	5	7	3	4	5	6	5	5	5	9	10	14	10	3	37	1	1	1	1	1	5	5	10	11	7	6	39	[illegible]	10	7	7	4	35	3	11	13	7	6	40	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	21	27	5	6	4	6	4	4	2	5	4	1	7	4	7	8	11	15	11	3	40	1	1	1	1	1	5	3	4	5	5	3	23	3	10	11	5	6	35	5	9	16	8	6	42	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	17	27	6	4	5	6	5	6	3	5	1	2	4	7	3	5	11	14	14	6	45	2	2	2	2	2	10	4	9	10	5	4	32	3	9	11	14	5	42	3	9	15	10	6	43	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	22	25	6	3	6	7	4	5	2	5	5	5	7	5	3	5	5	14	8	5	32	2	2	2	2	2	10	6	9	11	7	4	37	5	6	10	5	4	30	3	9	9	7	9	37	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	[illegible]	25	6	3	5	7	4	4	2	4	2	2	3	4	6	9	11	14	9	3	37	1	1	1	1	1	5	5	8	5	5	4	27	7	10	11	7	10	45	5	11	13	9	4	42	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	14	24	5	6	4	7	4	4	2	5	4	4	9	4	6	8	10	15	11	11	47	1	2	1	1	1	6	5	4	5	6	4	24	5	9	14	9	10	47	8	10	9	7	10	44	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	15	25	4	6	5	5	4	4	2	5	3	2	9	6	6	9	12	13	12	3	40	1	2	1	1	1	6	3	4	5	5	4	21	5	6	5	11	4	31	5	12	14	13	8	52	1	1	1	1	4	8

Contd.....

1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
[illegible]	[illegible]	[illegible]	13	18	40	7	4	7	6	6	10	1	6	6	3	5	6	3	5	10	13	13	6	39	2	2	2	2	2	10	6	9	14	6	7	42	8	14	6	13	9	46	6	11	10	13	6	46	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	15	18	42	8	8	8	7	6	5	2	6	4	4	5	6	3	5	12	14	13	5	40	2	2	3	2	2	11	6	6	9	6	5	32	8	12	6	12	7	42	10	11	14	13	8	56	2	2	2	2	1	9
[illegible]	[illegible]	[illegible]	15	18	42	4	4	6	6	6	7	3	4	3	9	5	4	6	5	15	14	13	5	40	3	3	3	2	2	13	8	11	13	10	8	50	8	13	8	12	9	46	8	10	9	8	9	46	2	3	2	2	2	11
[illegible]	[illegible]	[illegible]	14	20	40	7	3	7	6	6	6	3	4	6	3	7	8	3	7	9	11	13	9	33	2	2	2	2	1	9	3	8	8	8	5	32	9	9	3	14	5	40	8	11	14	10	7	50	2	1	1	1	1	6
[illegible]	[illegible]	[illegible]	14	20	41	3	3	3	8	8	7	4	4	1	6	5	8	7	5	11	13	10	8	34	2	2	2	2	2	10	8	7	8	6	5	34	9	10	8	9	4	40	7	11	14	10	7	49	2	2	1	1	1	7
[illegible]	[illegible]	[illegible]	13	17	41	5	6	3	4	6	4	6	5	5	4	3	4	7	3	13	14	10	8	37	2	2	2	2	1	9	6	5	9	8	3	31	8	9	6	8	5	36	10	11	8	10	6	46	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	14	22	39	6	6	3	2	4	6	4	4	9	4	4	3	7	7	13	14	11	8	36	2	2	2	2	2	10	9	13	11	11	10	54	7	13	13	14	5	50	8	11	12	15	12	58	3	3	3	1	4	14
[illegible]	[illegible]	[illegible]	14	26	39	3	7	3	8	4	5	5	4	4	4	3	3	7	5	10	11	10	5	36	1	1	2	2	2	8	6	12	9	8	8	43	7	8	7	9	10	41	10	13	15	10	12	60	2	2	2	2	1	9
[illegible]	[illegible]	[illegible]	13	16	39	4	8	3	6	6	7	4	5	3	4	3	7	5	6	14	14	13	5	46	1	1	1	1	1	5	5	11	10	6	5	37	2	5	3	10	5	30	10	14	14	12	6	56	3	2	2	2	4	13
[illegible]	[illegible]	[illegible]	13	18	38	7	3	7	7	6	7	2	5	5	2	3	8	3	5	18	14	10	8	34	2	2	2	2	2	10	6	11	9	7	7	40	4	8	6	9	7	37	8	11	9	7	6	41	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	14	19	38	7	3	6	7	7	10	4	5	6	3	3	6	3	7	12	12	12	5	41	2	1	2	2	2	9	4	6	5	6	6	27	8	6	8	14	5	42	4	7	11	8	7	37	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	14	18	38	3	6	4	5	6	4	4	4	5	4	6	3	3	6	12	15	7	8	34	3	3	1	1	1	10	5	8	8	10	7	38	4	8	9	9	8	38	10	14	9	10	9	52	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	16	17	37	6	7	5	5	7	10	4	4	5	3	3	6	7	5	11	11	10	0	32	1	2	3	2	2	10	7	9	12	8	7	42	7	8	9	10	8	42	9	13	17	14	8	61	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	13	18	37	6	4	7	4	6	8	5	7	2	6	9	3	9	4	15	16	9	5	43	3	3	3	3	3	15	6	10	13	9	5	43	7	10	13	8	8	46	8	11	12	8	14	53	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	14	15	35	6	4	2	10	5	6	6	4	5	4	5	3	4	8	10	11	12	5	47	1	1	1	1	1	5	6	11	14	12	9	52	8	11	10	13	5	47	6	13	14	14	13	60	2	3	3	2	4	14
[illegible]	[illegible]	[illegible]	16	17	34	4	2	3	9	5	9	5	4	5	6	4	2	7	6	12	15	11	5	43	2	2	2	1	2	9	6	10	9	9	8	42	8	7	6	10	7	38	10	14	18	18	14	74	2	3	2	2	2	11
[illegible]	[illegible]	[illegible]	16	19	33	3	6	6	4	7	4	4	5	5	5	7	6	3	7	13	6	10	0	29	2	2	2	2	2	10	5	10	9	5	5	34	8	10	9	12	9	46	8	4	5	6	4	27	1	1	1	1	1	5

Contd....

[illegible]	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
[illegible]	[illegible]	15	12	10	10	7	8	5	4	1	6	4	3	9	6	5	1	6	7	15	13	7	15	50	1	1	1	1	1	5	6	8	14	12	6	46	10	14	10	12	8	54	10	14	16	18	16	74	3	3	3	2	2	13
[illegible]	[illegible]	17	16	17	30	7	4	8	3	6	10	6	9	6	4	3	4	6	9	17	13	12	6	48	1	2	1	1	1	6	6	9	14	13	9	51	6	9	10	11	8	44	10	14	16	17	14	71	3	3	3	3	2	14
[illegible]	[illegible]	[illegible]	15	14	36	4	6	4	5	6	5	3	9	3	5	9	4	3	4	15	10	10	15	50	3	3	3	3	3	15	7	13	15	10	8	53	8	11	12	10	6	47	10	13	12	8	8	51	2	2	2	2	4	12
[illegible]	[illegible]	[illegible]	15	20	36	3	7	3	3	6	7	4	6	4	3	7	4	4	3	9	15	9	6	39	1	2	2	3	1	9	6	8	11	11	8	44	7	9	10	12	8	46	6	13	16	16	6	57	3	4	4	3	3	17
[illegible]	[illegible]	[illegible]	16	17	38	3	7	5	8	7	6	4	4	5	7	9	2	2	4	14	15	15	13	57	3	1	2	2	2	10	4	4	10	16	9	43	10	13	12	13	8	56	9	14	16	16	10	65	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	14	16	34	4	4	4	4	6	5	3	5	3	9	9	6	3	4	13	14	11	15	53	1	1	1	1	1	5	7	10	11	10	8	46	9	13	17	17	13	69	9	13	17	17	12	68	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	14	19	34	5	7	5	6	7	6	4	4	5	7	9	2	3	4	15	13	11	15	54	1	1	1	1	1	5	6	10	13	12	9	50	9	13	17	17	13	69	9	13	17	17	13	69	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	15	19	34	5	7	5	6	7	6	4	4	5	7	9	2	2	4	15	15	12	15	57	2	2	2	2	2	10	6	6	10	8	9	39	6	10	11	8	7	42	10	7	7	10	7	41	1	1	1	1	2	6
[illegible]	[illegible]	[illegible]	[illegible]	20	32	7	6	1	10	10	7	4	2	8	7	7	4	3	10	14	15	15	15	59	2	2	2	2	2	10	7	8	10	10	9	44	10	13	17	17	14	71	9	13	17	17	13	69	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	[illegible]	14	41	7	6	4	3	5	7	2	9	4	6	7	4	4	3	11	15	11	15	52	1	2	2	2	2	9	8	12	9	12	9	50	9	14	18	18	12	71	7	13	9	6	5	40	1	1	1	1	4	8
[illegible]	[illegible]	[illegible]	[illegible]	16	32	7	6	3	1	3	7	3	5	5	4	6	4	6	5	12	15	14	15	56	2	2	2	2	2	10	7	14	9	11	8	49	10	14	18	18	8	68	11	15	18	18	8	70	2	2	2	2	5	13
[illegible]	[illegible]	[illegible]	[illegible]	15	32	7	7	9	9	7	7	2	6	4	1	7	3	4	4	14	15	14	15	58	2	2	2	2	2	10	6	8	10	10	8	42	10	12	11	10	8	51	9	14	18	16	8	65	1	1	1	1	1	5
[illegible]	[illegible]	[illegible]	[illegible]	17	32	6	7	3	6	4	6	3	3	7	6	10	6	5	6	12	10	10	11	43	2	2	2	2	2	10	8	10	11	11	8	48	10	14	14	15	13	66	9	13	18	17	13	70	1	1	2	1	2	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7	7	3	8	7	5	4	3	4	4	7	3	4	10	12	16	10	15	53	2	2	2	2	2	10	7	10	10	10	9	46	8	10	13	11	8	50	10	10	16	16	12	54	2	2	2	2	4	12
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6	7	4	6	6	5	5	5	5	4	6	4	6	4	14	12	11	15	52	2	2	1	1	1	7	6	10	8	8	7	39	7	11	10	9	8	45	9	14	12	10	8	53	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8	4	5	6	6	6	4	4	4	7	5	6	4	15	8	15	13	51	1	2	2	2	2	9	8	10	14	11	8	51	10	14	18	18	14	74	9	13	17	17	13	69	1	2	2	2	4	11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7	7	2	7	5	5	4	5	9	4	6	6	13	15	8	13	49	1	2	2	2	2	9	6	8	10	10	8	42	6	10	11	10	8	45	6	8	16	12	8	50	2	2	2	2	4	12
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6	5	6	6	2	5	4	7	10	3	7	6	11	13	13	11	48	2	2	2	2	2	10	8	9	13	9	8	47	8	11	11	11	13	54	6	12	14	15	7	54	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	5	8	7	4	5	7	6	9	3	6	5	11	15	12	13	51	2	2	2	1	2	9	5	11	9	8	8	41	6	10	10	11	8	45	10	14	18	13	8	63	2	2	2	2	2	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	7	7	4	6	6	6	7	4	2	4	13	15	11	15	54	2	1	1	1	1	6	5	8	10	10	8	41	9	13	11	11	8	52	9	13	15	8	7	52	1	1	1	1	1	5

APPENDIX 3

LIST OF VARIABLES IN THE PRESENT STUDY

The data was collected using the various instruments and procedures mentioned earlier. In all there are 92 variables.

S. No.	Serial No. of variables	Description	Abbrevation
1	2	3	4
1.	1	Intelligence	I.Q.
2.	2	Socio-economic status	S.E.S.
3.	3	Education of Parents	Edu.
4.	4	Occupation of Parents	Occ.
5.	5	Income of Parents	In.
6.	6	Personality	Per.
7.	7	Reserved / warm hearted	A
8.	8	Dull / Bright	B
9.	9	Affected by feelings / emotionally stable	C
10.	10	Undemonstrable / excitable	D
11.	11	Obedient / assertine	E
12.	12	Sober / Enthusiastic	F
13.	13	Disregards rules/conscientious	G
14.	14	Shy / Advanturous	H
15.	15	Tough-minded / Tender minded	I
16.	16	Zestful / Circumspect individualism	J
17.	17	Self-answered/Apprehensive	O
18.	18	Socially group dependent/ self-sufficient	Q_2

Contd.....

1	2	3	4
19.	19	Uncontrolled / Controlled	Q_3
20.	20	Relaxed / Tense	Q_4
21.	21	Stimulating Problem Number 1 (digital problem)	SP-1
22.	22	Stimulating Problem Number 2 (Beaker Problem)	SP-2
23.	23	Stimulating Problem Number 3 (Magic Seed Problem)	SP-3
24.	24	Stimulating Problem Number 4 (Worm Problem)	SP-4
25.	25	Total socres in stimulating problem	T.SP
26.	26	Problem one Pre-test of control group	C.Pr.t-1
27.	27	Problem one Post-test of control group	C.Po-t-1
28.	28	Problem two Pre-test of control group	C.Pr.t-2
29.	29	Problem two Post-test of control group	C.Po.t-2
30.	30	Problem three Pre-test of control group	C.Pr.t-3
31.	31	Problem three Post-test of control group	C.Po.t-3
32.	32	Problem four Pre-test of control group	C.Pr.t-4
33.	33	Problem four Post-test of control group	C.Po.t-4
34.	34	Problem five Pre-test of control gfoup	C.Pr.t-5
35.	35	Problem five Post-test of control group	C.Po.t-5

Contd....

1	2	3	4
36.	36	Total scores in all the problems of Pre-test of control group	C.T.Pr.t.
37.	37	Total scores in all the problems of Post-test of control group	C.T.Po.t
38.	38	Problem one Pre-test of Experimental group	E.Pr.t-1
39.	39	Problem one Post-test of Experimental group	E.Po.t-1
40.	40	Problem two Pre-test of Experimental group	E.Pr.t-2
41.	41	Problem two Post-test of Experimental group	E.Po.t-2
42.	42	Problem three Pre-test of Experimental group	E.Pr.t-3
43.	43	Problem three Post-test of Experimental group	E.Po.t-3
44.	44	Problem four Pre-test of Experimental group	E.Pr.t-4
45.	45	Problem four Post-test of Experimental group	E.Po.t-4
46.	46	Problem five Pre-test of Experimental group	E.Pr.t-5
47.	47	Problem five Post-test of Experimental group	E.Po.t-5
48.	48	Total scores in all the problem of Pre-test of experimental group	E.T.Pr.t
49.	49	Total scores in all the problem of Post-test of experimental group	E.T.Po.t
50.	50	First training session - first problem	I.T.S.-1

Contd....

1	2	3	4
51.	51	Second training session of first problem	II.T.S.-1
52.	52	Third training session of first problem	III.T.S.-1
53.	53	First training session of second problem	I.T.S.-2
54.	54	Second training session of second problem	II.T.S.-2
55.	55	Third training session of second problem	III.T.S.-2
56.	56	First training session of third problem	I.T.S.-3
57.	57	Second training session of third problem	II.T.S.-3
58.	58	Third training session of third problem	III.T.S.-3
59.	59	First training session of fourth problem	I.T.S.-4
60.	60	Second training session of fourth problem	II.T.S.-4
61.	61	Third training session of fourth problem	III.T.S.-4
62.	62	First training session of fifth problem	I.T.S.-5
63.	63	Second training session of fifth problem	II.T.S.-5
64.	64	Third training session of fifth problem	III.T.S.-5
65.	65	Total scores in first training session	T.T.S.I
66.	66	Total scores in second training session	T.T.S.II

Contd....

1	2	3	4
67.	67	Total scores in third training session	T.T.S.III
68.	68	Age	Ag
69.	Eb 1 - Eb 20	Experimental group boys grade V, age 9+	
70.	Eb 21 - Eb 40	Experimental group boys grade VI, age 10+	
71.	Eb 41 - Eb 60	Experimental group boys grade VII, age 11+	
72.	Eb 61 - Eb 77	Experimental group boys grade VIII,age 12+	
73.	Eb 78 - Eb 94	Experimental group boys gradeIX, age 13+	
74.	Eb 95 - Eb 111	Experimental group boys grade X, age 14+	
75.	Eg 1 - Eg 20	Experimental group girls grade V, age 9+	
76.	Eg 21 - Eg 40	Experimental group girls grade VI, age 10+	
77.	Eg 41 - Eg 58	Experimental group girls grade VII, age 11+	
78.	Eg 59 - Eg 78	Experimental group girls grade VIII,age 12+	
79.	Eg 79 - Eg 95	Experimental group girls grade IX, age 13+	
80.	Eg 96 - Eg 115	Experimental group girls grade X, age 14+	
81.	Cb 1 - Cb 20	Control group boys grade V, age 9+	
82.	Cb 21 - Cb 40	Contfol group boys grade VI, age 10+	
83.	Cb 41 - Cb 59	Control group boys grade VII, age 11+	
84.	Cb 60 - Cb 78	Control group boys grade VIII, age 12+	
85.	Cb 79 - Cb 92	Control group boys grade IX, age 13+	
86.	Cb 93 - Cb 117	Control group boys grade X, age 14+	
87.	Cg 1 - Cg 20	Control group girls grade V, age 9+	
88.	Cg 21 - Cg 40	Control group girls grade VI , age 10+	

Contd.....

प्रश्न - पत्र

भाग - १

(Stimulating Problems)

विद्यार्थी का नाम..

कक्षा और श्रेणी..

आयु..

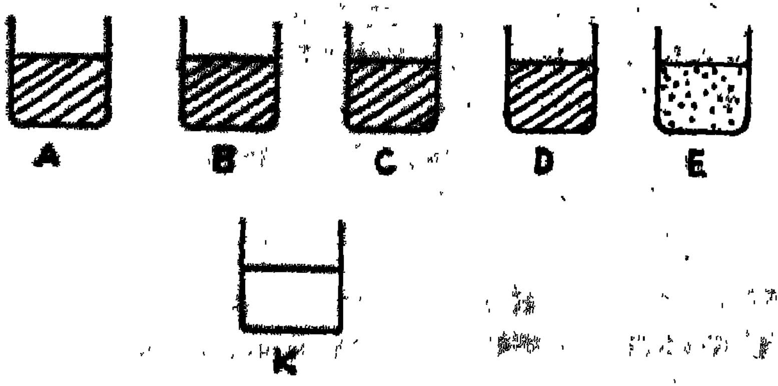
लिंग..

सेक्शन..

स्कूल का नाम..

तिथि..

समस्या नं० २



मेरे पास चार बीकर A, B, C, D, हैं । इन बीकरों में द्रव भरा है । बीकर E में भी द्रव भरा है । बीकर K खाली है । मैंने बीकर E का द्रव K में डाला फिर बीकर A, B, C, D, का द्रव बारी बारी से बीकर K में डाला । बीकर K के द्रव का रंग पीला हो गया । यह पीला रंग किन किन बीकर के द्रवों से मिल कर बना होगा ?

उत्तर—बीकर K में यदि बीकर E का द्रव तथा बीकर A का द्रव मिलाया गया है तो सुविधा के लिए हम इसे A+E भी लिख सकते हैं । आप भी ऐसे ही अनेक संयोग बनाईये ।

1. A+E　2.　3.　4.　5.

6.　7.　8.　9.　10.

11.　12.　13.　14.　15.

16.　17.　18.　19.　20.

समस्या नं० ३

एक किसान के पास एक थैले में कुछ आलू बीज है । वह उनसे स्वस्थ पौधे उगाना चाहता है । उसे केवल यह मालूम है कि उन्हें उगाने के लिए तीन तत्वों की आवश्यकता है । पानी, खाद और धूप । उसकी समस्या इन तीनों तत्वों की सही मात्रा का प्रयोग करना है । वह मिट्टी के कुछ गमले खरीद लाया । प्रत्येक तत्व को तीन मात्रा में निम्न प्रकार से विभाजित किया ।

पानी — अधिक, मध्यम, कम
खाद — अधिक, मध्यम, कम
धूप — अधिक, मध्यम, कम

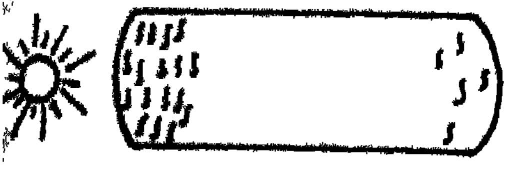
इसके पश्चात् इन तत्वों की विभिन्न मात्रा के अनुसार बीज बो दिये । पहले गमले में बीज को अधिक मात्रा में पानी, अधिक मात्रा में खाद और अधिक मात्रा में धूप दी ।

विभिन्न मात्रा के विभिन्न तत्वों का प्रयोग करते हुए आप यह बताइये कि किसान को कितने गमले तैयार करने पड़ेंगे ।

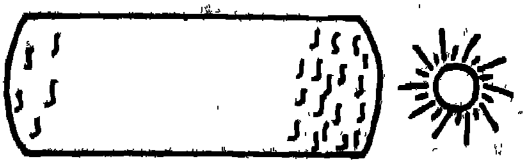
उत्तर	संख्या गमला	पानी अधिक	खाद अधिक	धूप अधिक
	1.			
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
	11.			
	12.			
	13.			
	14.			
	15.			
	16.			
	17.			
	18.			
	19.			
	20.			
	21.			
	22.			
	23.			
	24.			
	25.			
	26.			
	27.			
	28.			
	29.			
	30.			

समस्या नं० ४

एक बालक के पास कुछ कीड़े हैं । वह उन कीड़ों को पालना चाहता है । उसने उन कीड़ों को चार कांच के डिब्बों में रखा । प्रत्येक डिब्बे को रोशनी (बल्ब) के पास रखा । प्रत्येक डिब्बे को निम्न चित्रों के अनुसार विभिन्न परिस्थितियों में रखकर वह यह जानना चाहता है कि कीड़ों को जीवित रखने के लिए सबसे आवश्यक बात क्या है ।

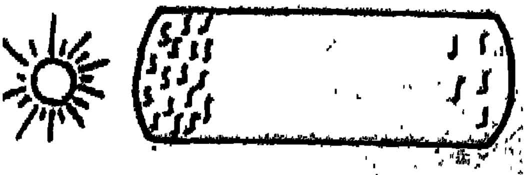


(1)

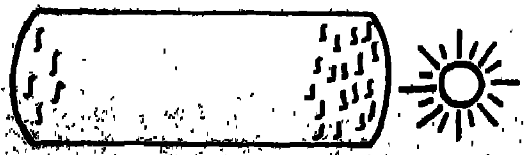


(2)

रोशनी सूखा गीला सूखा गीला रोशनी



(3)



(4)

रोशनी सूखा सूखा गीला गीला रोशनी

इन चित्रों को देखकर आगे दिये गये प्रश्नों के उत्तर दीजियें ।

प्रश्न 4 (अ) चित्र १ और ३ को देखकर बताइये कि कीड़ों की गतिविधि किस प्रकार की है ।

उत्तर—..

....

(ब) चित्र २ और ४ को देखकर बताइये कि कीड़ों की गतिविधि किस प्रकार की है ।

उत्तर—..

....

(स) प्रश्न अ और प्रश्न ब के आधार पर बताइये कि कीड़ों को जीवित रखने के लिए कौन सा तत्व सबसे अधिक आवश्यक है ?

उत्तर—..

....

किशोरावस्था के विद्यार्थियों की विचार-प्रक्रियाओं

का

जाँच—पत्र

(Pre-test)

विद्यार्थी का नाम..

लड़का या लड़की..

आयु..

कक्षा..

सैक्शन..

स्कूल का नाम..

तिथि..

निर्देशन :-

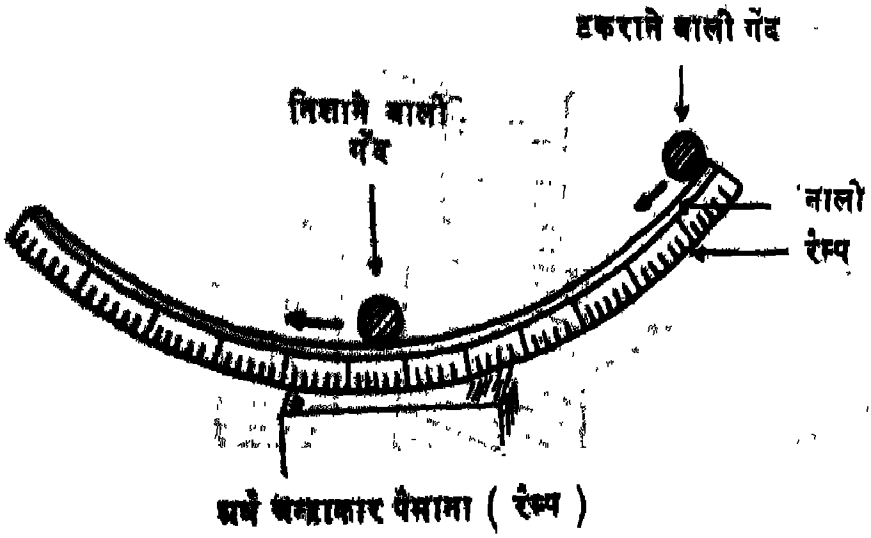
इस प्रश्नपत्र में आपको कुछ समस्याएँ दी जा रही हैं। इन समस्याओं के द्वारा मैं यह ज्ञात करना चाहती हूँ कि आपके उम्र के विद्यार्थी किसी भी समस्या के समाधान के लिए किस प्रकार से विचार करते हैं। आप प्रत्येक समस्या को ध्यानपूर्वक पढ़िये। प्रत्येक समस्या का अपने ढंग से सोच कर उत्तर दीजिए। कोई भी उत्तर सही या गलत नहीं है।

इस प्रश्नपत्र का आपकी परीक्षा से कोई सम्बन्ध नहीं है। आपके प्रश्नों को गोपनीय रखा जायेगा। अतः निःसंकोच होकर उत्तर दीजिए। आपके उत्तरों का प्रयोग केवल शोध कार्य के लिए ही किया जायेगा।

प्रत्येक समस्या के नीचे खाली जगह छोड़ी गई है। आप कृपया उसी स्थान में अपना हल लिखिए। यदि स्थान अपर्याप्त हो तो आप अतिरिक्त खाली पृष्ठ ले सकते हैं।

धन्यवाद।

समस्या नं० ३



एक अर्ध चन्द्राकार पैमाना (रैम्प) है जिसके बीच में एक नाली (खांचा) है। इस नाली में गेंद ऊपर नीचे लुढ़क सकती है।

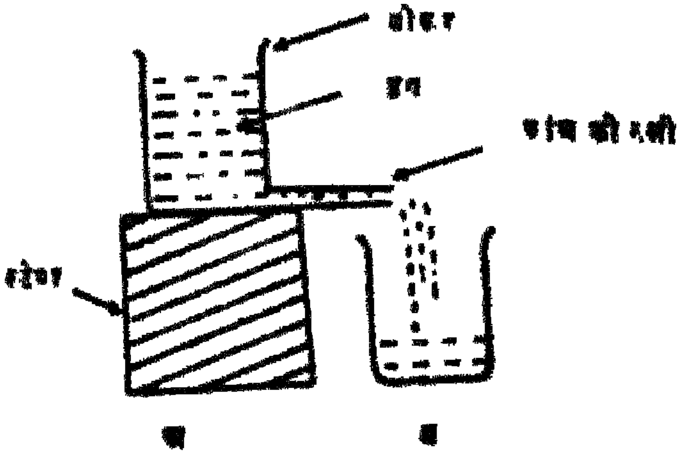
पैमाने के मध्य में निशाने के लिये एक गेंद रखी हुई है। दायें किनारे से निशाना लगाने के लिये गेंद लुढ़काई जाती है, जो बीच में रखी गेंद से टकराती है। निशाने वाली गेंद बायी ओर कुछ दूरी तक लुढ़क जाती है। निशाने वाली गेंद का लुढ़कना किन-किन बातों पर निर्भर करेगा ?

१ ____

____

____

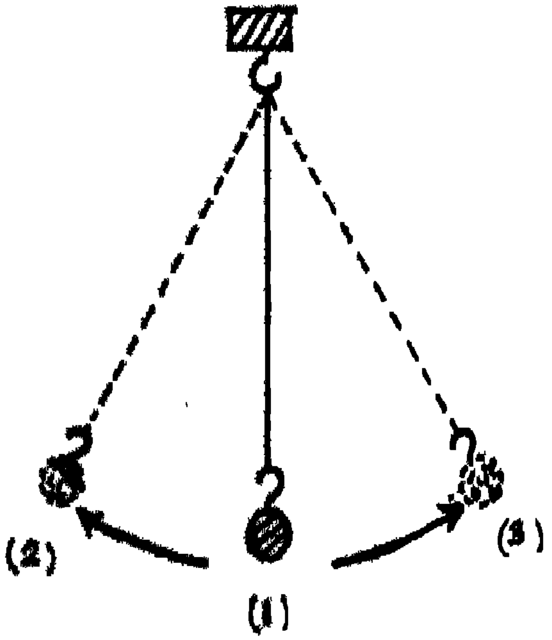
समस्या नं० ४



हमारे पास दो काँच के बीकर अ और ब हैं। बीकर अ में द्रव भरा है। बीकर अ, बीकर ब से अधिक ऊँचाई पर रखा हुआ है। बीकर अ में एक काँच की नली लगी हुई है। बीकर अ का द्रव काँच की नली से बहता हुआ बीकर ब में गिर रहा है। बीकर ब में द्रव का गिरना किन-किन बातों पर निर्भर करेगा?

उत्तर—

समस्या नं० ५



यह एक लोलक का चित्र है। यदि गोला संख्या एक को धीरे से धक्का लगाया जाये तो वह हिलने लगेगा। गोले की स्थिति १ से २, २ से १, १ से ३, ३ से १ पर पुनः आने पर गोले का एक झूला पूरा होता है। यह झूला किन-किन बातों पर निर्भर करता है?

११ ....

....

....

जाँच--पत्र

(Training Session)

ार्थी का नाम ______________________________

ड़का या लड़की ______________________________

यु ______________________________

क्षा ______________________________

थान ______________________________

ूल का नाम ______________________________

थि ______________________________

निर्देश

आपके सामने कुछ प्रयोग किये जायेंगे। इन्हें आप ध्यानपूर्वक देखिये। प्रयोग के प्रत्येक चरण बन्धित प्रश्न इस प्रश्न पत्र में दिये गये हैं। आप प्रयोग को देखकर इनसे सम्बन्धित जो पूछे गये हैं उनका उत्तर दीजिए। प्रत्येक उत्तर के नीचे स्थान छोड़ा गया है। कृपया उसी खिये। स्थान अपर्याप्त हो तो आप अतिरिक्त कापी पृष्ठ ले सकते हैं। जब तक कहा न अगले प्रश्न को हल मत कीजिये।

धन्यवाद

समस्या नं. १

एक धातु की छड़ पर कुछ मोम की गोलियां चिपकाई गई हैं। छड़ का एक सिरा गर्म किया जाता है। कुछ समय के बाद मोम की गोलियां गिरने लगती हैं। मोम की गोलियों का गिरना किन परिवर्तियों (Variables) पर निर्भर करता है ?

इन विभिन्न छड़ों की मोटाई समान है किन्तु धातु भिन्न है। (दिखाते हुए) मोम की गोलियों में जो गिरने का समय लगा उससे आप क्या निष्कर्ष निकाल सकते हैं ?

इन विभिन्न छड़ों की धातु तो समान है, किन्तु इन छड़ों की मोटाई भिन्न है। (दिखाते हुए) मोम की गोलियों में जो गिरने का समय लगा उससे क्या निष्कर्ष निकाल सकते हैं ?

समस्या नं. २

ये विभिन्न धातुओं की बनी छड़ें हैं। जिन्हें एक लकड़ी की पट्टी में लगा सकते हैं। (दिखाते हुए) इनकी प्रभावी लम्बाई लकड़ी की पट्टी की सतह से छड़ के सिरे तक होती है। इन छड़ों को आगे पीछे खिसका कर प्रभावी लम्बाई को बनाया जा सकता है। ये छड़ें एक दूसरे से भिन्न हैं। यदि इन छड़ों के सिरे पर भार लटकाए जायें तो छड़ों का झुकाव भिन्न-भिन्न परिवर्तियों (variables) पर निर्भर करेगा।

____

____

____

____

(दिखाते हुए) इन छड़ों की मोटाई तथा धातु समान है। छड़ों की लम्बाई भिन्न है। आप छड़ों के झुकाव को देखकर क्या निष्कर्ष निकाल सकते हैं?

____

____

____

____

इन छड़ों की मोटाई और लम्बाई समान है तथा प्रत्येक छड़ की धातु भिन्न है। (दिखाते हुए) आप छड़ों के झुकाव को देखकर क्या निष्कर्ष निकाल सकते हैं।

____

____

____

____

इन छड़ों की लम्बाई तथा धातु एक समान है। प्रत्येक छड़ की मोटाई भिन्न है। (दिखाते हुए) आप छड़ों के झुकाव को देखकर क्या निष्कर्ष निकाल सकते हैं?

____

____

____

____

समस्या नं. 3

1. इस रैम्प के बिल्कुल बीच में एक निशाने वाली गेंद रखी हुई है। (दिखाते हुए) रैम्प के एक सिरे से एक पीटने वाली बॉल लुढ़काई जाती है वह निशाने वाली बॉल से टकराती है। निशाने वाली बॉल अपनी जगह से सरक जाती है। यह निशाने वाली बॉल का सरकना किन-किन परिस्थितियों पर निर्भर करता है ?

1, निशाने वाली बॉल का भार पीटने वाली बॉल से कम है। दोनों बॉल का आयतन व धातु, रैम्प का angle.) सतह समान है। उस ऊंचाई पर जहां तक निशाने वाली बॉल पीटने वाली बॉल के कारण पहुंचति है निशान लगा लिया जाता है। अब निशाने वाली बॉल को पीटने वाली बॉल से अधिक भारी वाली बॉल से बदल दिया जाता है। निशाने वाली बॉल को पीटने पर इसके द्वारा ग्रहण की ऊंचाई को नापा जाता है। दोनो स्थिति में ग्रहण की गई ऊंचाई से आप क्या निर्णय निकाल सकते हैं ?

3 निशाने वाली बॉल का आयतन पीटने वाली बॉल से कम है। बॉल का आकार, बॉल की धातु, बॉल का भार, रैम्प की सतह, रैम्प का angle समान है। पीटने वाली बॉल के द्वारा निशाने वाली बॉल की ग्रहण की गई ऊंचाई नापी जाती है। निशाने वाली बॉल का आयतन अब पीटने वाली बॉल से अधिक है। टकराने के कारण ग्रहण की गई ऊंचाई नापी जाती है। अब पीटने वाली बाल तथा निशाने वाली बाल का आयतन समान है। टकराने के कारण निशाने वाली बाल के द्वारा ग्रहण की गई ऊंचाई नापी जाती हैं। तीनों स्थिति में ग्रहण की गई ऊंचाई से आप क्या निष्कर्ष निकाल सकते हैं ?

4. निशाने और पीटने वाली बॉल का भार, धातु और आयतन समान है। रैम्प की सतह समान है। रैम्प का angle बदल दिया है। दोनों स्थिति में निशाने वाली बाल के द्वारा ग्रहण की गई ऊंचाई नापी जाती है। दोनों स्थिति में ग्रहण की गई ऊंचाई से आप क्या निष्कर्ष निकाल सकते हैं।

5. निशाने और पीटने वाली बाल का आयतन, भार, धातु समान है। रैम्प का angle भी समान है। रैम्प की सतह बदल दी गई है। एक सतह लकड़ी की है, दूसरी सतह टीन की और तीसरी रबड़ की है। तीनों स्थिति में निशाने वाली बाल के द्वारा ग्रहण की गई ऊंचाई से आप क्या निष्कर्ष निकाल सकते है ?

समस्या नं. ४

चित्र में दो बीकर अ और ब दिखाए गए हैं। बीकर अ जिसमें कुछ द्रव है बीकर ब से कुछ ऊंचाई पर रखा हुआ है। बीकर अ में एक कांच की नली है जिसके द्वारा बीकर अ का द्रव बहकर बीकर ब में एकत्रित हो रहा है। बीकर अ की नली द्वारा द्रव का बहना किन-किन परिस्थितियों पर निर्भर करता है।

____

____

____

____

चित्र तीन बीकर अ-1 अ-2 और अ-3 दिखाये गए हैं। तीनों बीकरों में द्रव की मात्रा समान है। तीनों बीकरों की ऊंचाई बीकर ब-1 ब-2 और ब-3 से समान है। तीनों बीकरों के नलों का क्षेत्र समान है। तीनों बीकरों की लम्बाई भिन्न है। अ-1 की लम्बाई 5 से.मी. नली अ-2 की लम्बाई 10 से. मी नली अ 3 की लम्बाई 15 से.मी. है। तीनों नलियों से बहते द्रव का समय ज्ञात किया जाता है। तीनों स्थिति में द्रव एकत्रित होने का समय समान है। इस प्रयोग से आप क्या निष्कर्ष निकाल सकते हैं?

____

____

____

____

बीकर अ-1 अ-2 तथा अ-3 की बीकर ब-1 ब-2 तथा ब-3 से ऊंचाई भिन्न है। प्रत्येक बीकर से द्रव का गिरने का समय ज्ञात किया जाता है तथा यह पाया गया कि प्रत्येक बीकर से द्रव गिरने का समय समान है। इस प्रयोग से आप क्या निष्कर्ष निकाल सकते हैं?

____

____

____

____

बीकर ब-1 ब 2 तथा ब-3 की बीकर ब-1 ब-2 तथा ब-1 ब-2 तथा ब-3 से ऊंचाई समान है। नली की लम्बाई और व्यास भी समान है। द्रव की मात्रा प्रत्येक बीकर में भिन्न है। प्रत्येक बीकर से द्रव गिरने का समय ज्ञात किया जाता है। प्रत्येक स्थिति में समय असमान है। इससे आप क्या निष्कर्ष निकाल सकते हैं।

बीकर ब-1 ब-2 तथा ब-3 की बीकर ब-1 ब-2 तथा ब-3 से ऊंचाई समान है। प्रत्येक बीकर में द्रव की मात्रा भी समान है। नलियों की लम्बाई भी समान है। प्रत्येक नली का व्यास (छेद) भिन्न है। द्रव के बहने का समय प्रत्येक स्थिति में भिन्न है। इस प्रयोग से आप क्या निष्कर्ष निकाल सकते हैं ?

समस्या नं. ५

यह एक लोलक है। यदि हम बॉब को धक्का लगाते हैं तो बॉब हिलने लगता है। (दिखाते हुए) जब यह संख्या 1 से 2, 2 से 1, 1 से 3 और 3 से 1 पर घूमता है तो लोलक का एक चक्र समाप्त होता है। इसे हम एक झूला कहते हैं। इस लोलक का हिलना कुछ परिस्थिति पर निर्भर करता है। क्या आप उन परिस्थितियों का नाम बता सकते हैं ?

ये तीन लोलक हैं। इन लोलकों में डोरी की लम्बाई व बॉब का आयतन समान है। बॉब का भार भिन्न है। (एक स्केल से तीनों को साथ हिलाते हुए) लोलक के झूलने की स्थिति को देख कर आप क्या निष्कर्ष निकाल सकते हैं ?

यह तीन लोलक हैं। इन तीनों लोलकों में डोरी की लम्बाई, बॉब का भार समान है। बॉब का आयतन भिन्न है। (एक स्केल से तीनों को हिलाते हुए) लोलक के झूलने की गति को देख कर आप क्या निष्कर्ष निकाल सकते हैं ?

यह तीन लोलक हैं। इन तीनों लोलकों में बॉब का भार व आयतन समान है। डोरी की लम्बाई भिन्न है। लोलक के झूलने की गति को देख कर आप क्या निष्कर्ष निकाल सकते हैं ?

किशोरावस्था के विद्यार्थियों की विचार-प्रक्रियाओं

का

जांच-पत्र

(Post - Test)

विद्यार्थी का नाम ____________________

लड़का या लड़की ____________________

आयु ____________________

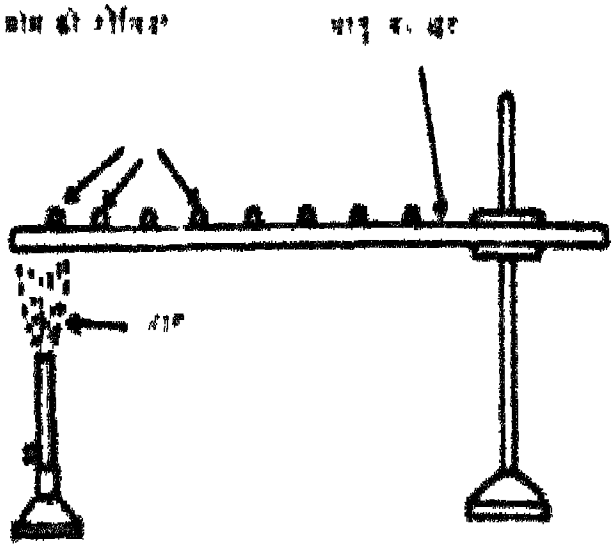
कक्षा ____________________

सेक्शन ____________________

स्कूल का नाम ____________________

तिथि ____________________

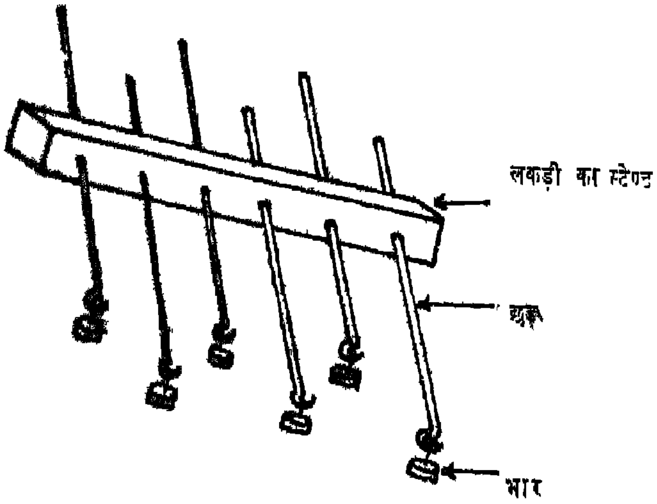
[illegible] नं० १



[illegible]

[illegible]—

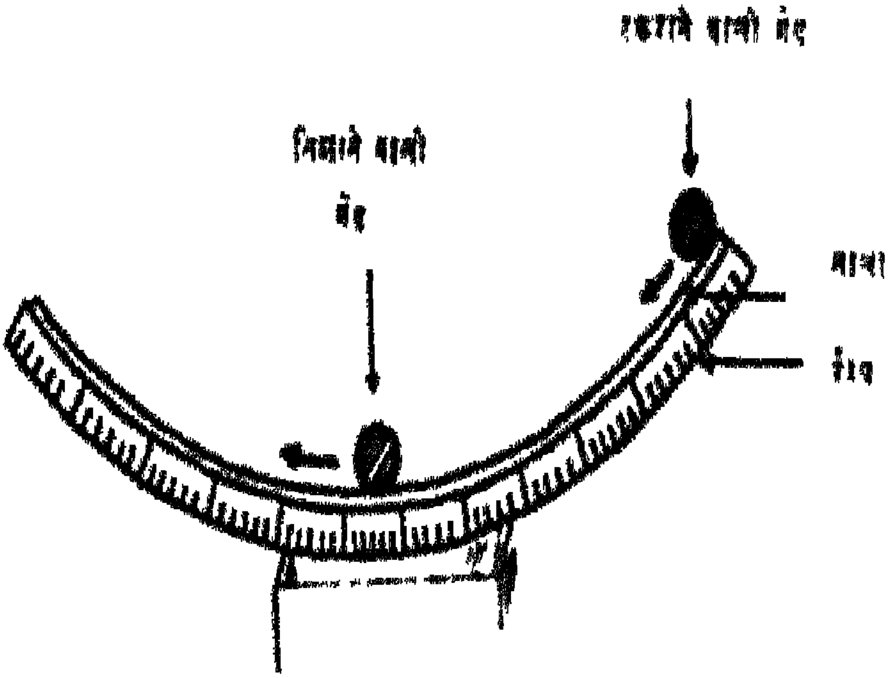
समस्या नं० २



ऊपर चित्र में धातु की छड़ें दिखाई गई हैं, जिन्हें एक लकड़ी की पट्टी में लगाया गया है। इन छड़ों की प्रभावी लम्बाई लकड़ी की पट्टी की सतह से छड़ के सिरे तक है। इन छड़ों को आगे पीछे खिसका कर प्रभावी लम्बाई को बदला जा सकता है। प्रत्येक छड़ के एक सिरे से भार लटकाया जाता है। छड़ें झुक जाती हैं। भार लटकाने की छड़ों का झुकना किन-किन परिवर्तियों (Variables) पर निर्भर करेगा ?

उत्तर—

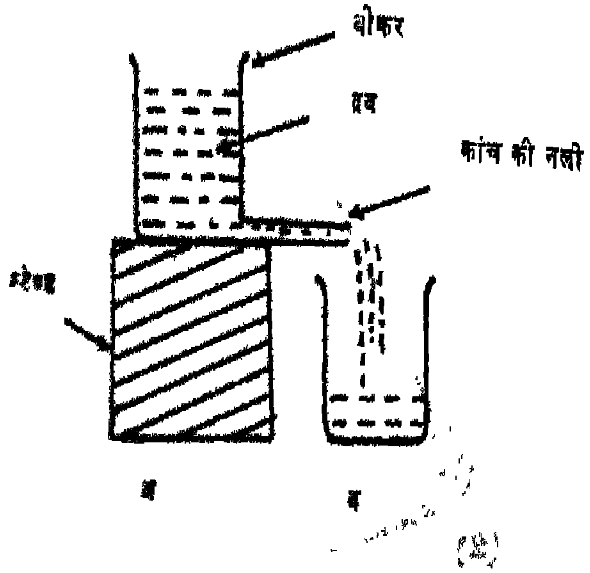
समस्या सं० ३



अर्ध चन्द्राकार पैमाना (स्केल)

एक अर्ध चन्द्राकार पैमाना (स्केल) है जिसके बीच में एक नाली (खांचा) है। इस नाली में गेंद ऊपर नीचे लुढ़क सकती है। पैमाने के मध्य में फिसलने के लिये एक गेंद रखी हुई है। यदि किनारे से टकराने वाली एक गेंद लुढ़काई जाती है, जो बीच में रखी गेंद से टकराती है। फिसलने वाली गेंद आगे और कुछ दूरी तक लुढ़क जाती है। फिसलने वाली गेंद का लुढ़कना किन किन बातों पर निर्भर करेगा ?

समस्या नं० ४



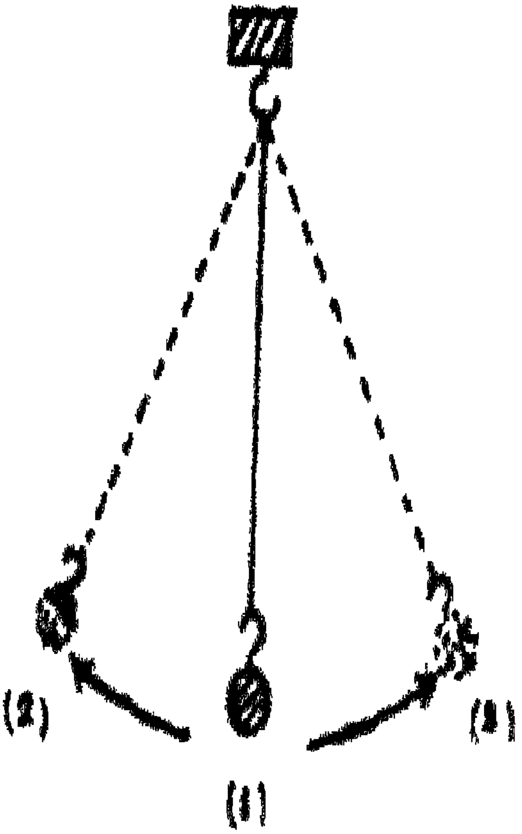
हमारे पास दो कांच के बीकर अ और ब हैं। बीकर अ में द्रव भरा है। बीकर अ, बीकर ब से अधिक ऊंचाई पर रखा हुआ है। बीकर अ में एक कांच की नली लगी हुई है। बीकर अ का द्रव कांच की नली से बहता हुआ बीकर ब में गिर रहा है। बीकर ब में द्रव का गिरना किन-किन बातों पर निर्भर करेगा?

____

____

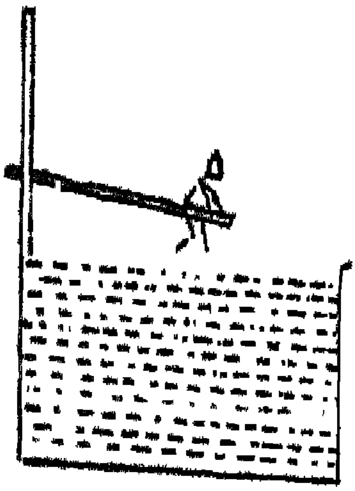
____

समस्या नं० ५



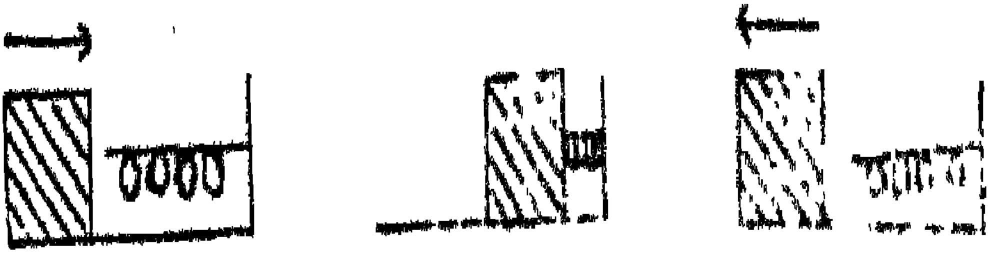
यह एक लोलक का चित्र है। यदि लोलक [illegible] एक ओर से धक्का लगाया जाये तो यह हिलने लगेगा। लोलक की स्थिति 1 से 2, 2 से 1, 1 से 3, 3 से 1 पर पहुँच कर लोलक का एक झूला पूरा होता है। यह झूला किन-किन बातों पर निर्भर करता है ?

समस्या नं० ६



ऊपर दिए गये चित्र में एक बालक एक धातु की छड़ पर बैठ कर झूल रहा है। वह छड को हिलाकर नीचे पानी की सतह को छूना चाहता है। क्या आप बता सकते हैं कि छड का झुकना किन परिस्थितियों पर निर्भर करता है ?

समस्या नं० ७



ऊपर दिये गये चित्र में [illegible] [illegible] [illegible] से आगे [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] वापस लौट आती है। [illegible] [illegible] [illegible] कारण [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] है?"

.4C

The PSYCHO CENTRE

Jr.-Sr.
H. S. P. Q.

FORM A
(Revised)

KVCJ 1967 Hindi Edition

Prepared by :

S. D. Kapoor and K. K. Mehrotra

(Original Test Authors are Dr. R. B. Cattell and Halla Beloff)

निर्देश

इस प्रश्नावली से तुम्हारे व्यक्तित्व के बारे में पता लगेगा। इसमें तुम्हारी पसन्द एवं रुचियों के विषय में प्रश्न दिये गये हैं। नको क्या करना है यह तो उदाहरणों द्वारा स्पष्ट कर दिया जायेगा। प्रश्न तुमको इस पुस्तिका में पढ़ने हैं और अपने उत्तर तुमको साथ में ये गये उत्तर-पत्र पर लिखने हैं। ध्यान रहे, न तो तुम्हें इस पुस्तिका पर कुछ लिखना है और न किसी प्रकार का कोई निशान लगाना है।

दाहरण :—

१ खाली समय में तुम क्या करना चाहोगे ?
(क) पुस्तकालय में अध्ययन करना, (ख) अनिश्चित, (ग) सैर-सपाटा करना।
२. किसी से झगड़ा होने पर क्या तुम आसानी से दुबारा मित्रता कर लेते हो ?
(क) हां, (ख) अनिश्चित, (ग) नहीं।

इन उदाहरणों से स्पष्ट है कि कोई भी उत्तर 'सही' या 'गलत' नहीं है। हर एक व्यक्ति की रुचियां अलग-अलग होती हैं, सलिये तुम अपने बारे में जैसा सोचते या समझते हो, केवल वही उत्तर सही और ठीक है। प्रत्येक प्रश्न के तीन उत्तरों में से एक उत्तर मको ऐसा मिलेगा जो औरों की अपेक्षा तुमको कुछ अधिक उपयुक्त लगेगा। अतः प्रत्येक प्रश्न के दिये हुए तीन उत्तरों में से किसी एक पर त्तर-पत्र में बने हुए खाने (Box) के अन्दर एक सही का (✓) निशान अवश्य लगाओ।

जिस प्रकार के प्रश्न ऊपर दिये गये हैं वैसे ही बहुत से प्रश्न इस पुस्तिका के भीतर तुमको मिलेंगे। जब तुमसे पन्ना पलटने े कहा जाए तो पहले प्रश्न से शुरू करो और अन्त तक करते चले जाओ। प्रश्न का उत्तर देते समय नीचे लिखी बातों पर ध्यान देना ावश्यक है :—

(१) प्रश्नों के उत्तर सच्चाई से तथा निस्संकोच भाव से दो, क्योंकि गलत उत्तर देने से तुम्हारा कोई लाभ नहीं है। तुम जैसे हो या जैसा करते हो वैसा ही उत्तर दो। यह मत सोचो कि कैसा उत्तर देना उचित है।

(२) यद्यपि इस प्रश्नावली के लिये कोई समय निश्चित नहीं है, फिर भी तुम प्रश्नों का उत्तर शीघ्रता से दो। तुम अपना निर्णय सोच-विचार कर देने की अपेक्षा तुरन्त मन में आये हुये विचारों के आधार पर दो। कुछ प्रश्न एक दूसरे से मिलते-जुलते मालूम पड़ते हैं परन्तु कोई भी दो प्रश्न बिलकुल एक से नहीं हैं। अतः तुम्हारे उत्तर भी अलग-अलग हो सकते हैं।

(३) बीच वाला उत्तर अर्थात "अनिश्चित" (या 'ख') केवल तभी प्रयोग में लाओ जबकि पहले या बाद वाले उत्तर का चुनाव बिलकुल असम्भव हो। अतः अधिकतर 'हां' (या 'क') 'नहीं' (या 'ग') के उत्तर ही प्रयोग में लाना चाहिये।

(४) किसी भी प्रश्न को मत छोड़ो। अगर कोई प्रश्न पूर्णतः तुम पर लागू नहीं हो या तुम्हारी रुचि के-अनुकूल न हो, केवल तभी तुम 'अनिश्चित' (या 'ख') के नीचे वाले खाने में निशान लगाओ।

अगर तुम्हें कुछ पूछना है तो अभी पूछ सकते हो, और यदि बाद में कोई कठिनाई समझनी हो तो स्वयं आकर पूछ सकते हो। किन्तु बगल में बैठे साथी को परेशान मत करो।

संकेत मिलने पर पन्ना उलटो और प्रश्नों का उत्तर देना आरम्भ कर दो।

Copyright © 1967 by The Psycho-Centre, T-22, Green Park, New Delhi-16 (India),
and also 1958, 1962, 1963 by the Institute for Personality & Ability Testing, 1602-04 Coronado Drive, Champaign, Illinois, U.S.A.
All rights reserved. International Copyright in all countries under the Berne Union, Buenos Aires, and Universal Copyright Conventions, and all Bilateral Copyright Agreements. Printed in India.

न निर्देशों को अभी तुमने पढ़ा है, क्या तुम उन्हें ठीक से समझ गये हो ?
[✓ (क) हाँ,] (ख) अनिश्चित, (ग) नहीं।

दि तुम किसी पिकनिक में गये हो तो, क्या थोड़े समय के लिये -
(क) अकेले इधर उधर घूमने निकल जाओगे, (ख) अनिश्चित, [✓ (ग) सब के साथ किसी मनोरंजन में भाग लोगे?]

"मरम्मत" का अर्थ है :
[✓ (क) ठीक करना,] (ख) साफ करना, (ग) उन्नति करना।

दि तुमसे कोई बेवकूफी हो जाती है तो क्या तुम इतना अधिक महसूस करते हो कि तुम्हारी इच्छा होती है कि पृथ्वी में गड़ जाओ ?
(क) हाँ, [✓ (ग) नहीं।]

क्या किसी समस्या पर तुम्हारा निर्णय अन्य लोगों की अपेक्षा :
[✓ (क) निश्चित होता है,] (ख) दोनों के बीच में (ग) हिचकिचाहट-पूर्ण होता है ?

जब कोई काम बुरी तरह बिगड़ जाता है तो बजाय उसे सुधारने के क्या तुम लोगों पर बहुत क्रोधित हो जाते हो ?
[✓ (क) अक्सर,] (ख) कभी-कभी, (ग) शायद ही कभी।

पने मित्र से विचारों में मतभेद होने पर, क्या तुम अपने अपने विचारों को इसलिए व्यक्त नहीं करते कि कहीं उनकी भावनाओं को ठेस न पहुँचे ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

क्या अधिकतर लोगों को तुम्हारे संग-साथ से आनन्द आता है ?
[✓ (क) हाँ, खूब,] (ख) लगभग साधारण, (ग) नहीं

क्या तुमको तंग गुफाओं में जाना या ऊँचे स्थानों पर चढ़ना नापसन्द है ?
(क) हाँ, [✓ (ख) कभी-कभी,] (ग) नहीं।

निम्नलिखित बातों में से कौन सी बात तुम्हारे व्यक्तित्व पर अधिक लागू होती है ?
[✓ (क) विश्वास योग्य नेता,] (ख) दोनों के बीच में, (ग) देखने में सुन्दर व आकर्षक।

क्या तुमको किसी बड़ी पार्टी या पिकनिक में जाने के पहले कभी-कभी ऐसा लगता है कि वहाँ जाने में तुम्हारी अधिक रुचि नहीं है ?
(क) हाँ, [✓ (ख) शायद,] (ग) नहीं।

जब तुम्हारा लोगों पर क्रोध करना उचित होता है तो क्या तुम सोचते हो कि उन पर तुम्हारा चिल्लाना बिल्कुल ठीक है ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

सहपाठियों द्वारा यदि तुम्हारा मजाक बन जाये, तो क्या तुम बिना विचलित हुए उसके समान आनन्द लेते हो ?
(क) हाँ, [✓ (ख) शायद,] (ग) नहीं।

क्या तुम हमेशा अपनी वास्तविक भावनाओं के बारे में बतला सकते हो, जैसे तुम थक गये हो या केवल बोर हो गये हो ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

क्या तुम सोचते हो कि समय आने पर तुम्हारे एक प्रसिद्ध और लोकप्रिय व्यक्ति बनने की उचित सम्भावना है ?
(क) हाँ, [✓ (ख) शायद,] (ग) नहीं।

प्राय: तुम्हें जितने अंक(नम्बर)मिला करते हैं उससे अधिक मिलने पर क्या तुमको ऐसा लगता है कि अध्यापक से कोई गलती हो गई हो?
(क) हाँ, [✓ (ख) शायद,] (ग) नहीं।

या तुम चाहोगे कि तुम देखने में अत्यधिक सुन्दर बनो जिससे कि तुम जिधर भी जाओ लोग तुम्हारी तरफ देखें ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

किसी बात से परेशानी अनुभव करने पर, क्या तुम :
[✓ (क) कुछ देर रुक कर शान्ति से काम लेते हो,] (ख) अनिश्चित, (ग) अपना गुबार निकाल देते हो ?

क्या तुम्हारे साथ किसी ने ऐसा मजाक किया है जिसकी याद से ही तुमको क्रोध होता है ?
[✓ (क) हाँ,] (ख) कभी-कभी, (ग) नहीं।

यदि तुम्हें अपने व्यक्तिगत विचारों व भावनाओं को व्यक्त करने का अवसर मिले, तो क्या तुम :
(क) कुछ विचारों को अपने ही मन में रखोगे, (ख) अनिश्चित, [✓ (ग) उन्हें व्यक्त करने में आनन्द का अनुभव करोगे ?]

क्या तुमको कभी नाटक में भाग लेने में आनन्द आया है, जैसे स्कूल के नाटक इत्यादि में ?
(क) हाँ, (ख) अनिश्चित, [✓ (ग) नहीं।]

"सत्य" का उल्टा है :
(क) काल्पनिक, [✓ (ख) झूठ,] (ग) अस्वीकृत।

स्कूल में जो भी पढ़ाया जाता है क्या उसे तुम पूरी तरह से समझ लेते हो ?
(क) हाँ, [✓ (ख) अधिकतर,] (ग) नहीं

यदि तुम्हारे मित्र कोई कार्य कर रहे हों और तुमको उसमें सम्मिलित न करें, तो क्या :
(क) तुम सोचोगे कि उन्होंने गलती की है, [✓ (ख) दोनों के बीच में,] (ग) तुम्हें ठेस लगेगी और क्रोध आयेगा ?

क्या लोगों का कहना है कि तुम कभी-कभी लापरवाह और ढीले-ढाले से रहते हो, यद्यपि उनके विचार में तुम अच्छे व्यक्ति हो ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

और लोगों की अपेक्षा क्या तुम कक्षा में अपने दोस्तों के साथ अधिक हँसते हो ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

क्या तुम प्रत्येक के सामने यह दिखाने के लिये तत्पर रहते हो कि तुम दूसरों की अपेक्षा कितना अच्छा कार्य कर लेते हो ?
(क) हाँ, [✓ (ख) शायद,] (ग) नहीं।

क्या तुम लोगों को यह बताना पसन्द करते हो कि वह कायदे-कानून का पालन करें ?
[✓ (क) हाँ,] (ख) कभी-कभी, (ग) नहीं।

आमतौर पर जब कोई तुमसे बहुत जल्दी-जल्दी या बहुत ही धीरे-धीरे बोलता है तो क्या तुम धैर्य से उसकी बात सुन लेते हो ?
(क) हाँ, (ख) कभी-कभी, [✓ (ग) नहीं।]

क्या तुम अजनबी लोगों के बीच बिना जरा सा भी घबराहट या कठिनाई का अनुभव किये वह बात कह लेते हो जो कहना चाहते हो ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

क्या कुछ विशेष प्रकार के चलचित्र तुमको विचलित कर देते हैं ?
(क) हाँ, [✓ (ख) शायद,] (ग) नहीं।

किसी सुहावनी सन्ध्या के समय तुम प्रायः क्या देखना पसन्द करोगे ?
(क) घुड़दौड़, (ख) अनिश्चित, [✓ (ग) खुले मैदान में संगीत का कार्यक्रम।]

क्या कभी-कभी तुम यह सोचते हो कि लोग इतने अज्ञानी हैं कि वह अपनी भलाई बुराई भी नहीं समझते ?
[✓ (क) सत्य है,] (ख) शायद, (ग) सत्य नहीं है।

क्या तुमको कभी-कभी ऐसा लगता है कि तुम बहुत अच्छे व्यक्ति नहीं हो, और न कभी कोई महत्वपूर्ण कार्य करते हो ?
(क) हाँ, (ख) अनिश्चित, [✓ (ग) नहीं।]

पहली कक्षा में क्या तुम बिना माँ के जोर डाले स्कूल चले जाते थे ?
[✓ (क) हाँ] (ख) कभी-कभी, (ग) नहीं।

क्या तुम कभी-कभी बेवकूफी की बातें केवल इसलिये कहते हो कि देखें लोग क्या कहते हैं ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

यदि तुम किसी काम में लगे हो और कोई ऊँचे स्वर में संगीत शुरू कर दे, तो क्या फिर भी तुम काम में लगे रह सकते हो ?
(क) हाँ, (ख) शायद, [✓ (ग) नहीं।]

क्या तुमको लगता है कि तुम्हारी अधिकांश आवश्यकताएँ उचित प्रकार से सन्तुष्ट होती रहती हैं ?
(क) हाँ, [✓ (ख) शायद,] (ग) नहीं।

4-04-

३९. संगीत या नृत्य में क्या तुम नई लय या ताल को आसानी से सीख लेते हो ?
[✓ (क) हां,] (ख) कभी-कभी, (ग) नहीं ।

४०. अपने सहपाठियों से बात करते समय क्या तुम अपनी अत्यन्त व्यक्तिगत भावनाओं को बताना आवश्यक करते हो ?
[✓ (क) हां,] (ख) कभी-कभी, (ग) नहीं ।

४१. "मितभाषी" शब्द का उल्टा है :
(क) कठोर, [✓ (ख) दयालु,] (ग) वाचाल ।

४२. क्या ब्लैक बोर्ड पर चाक (खड़िया) की रगड़ तुमको अजीब सी लगती है ?
(क) हां, (ख) शायद, (ग) नहीं ।

४३. बिना शोरगुल से प्रभावित हुए क्या तुम लगन से कार्य कर सकते हो ?
[✓ (क) हां,] (ख) शायद, (ग) नहीं ।

४४. क्या अन्य लोगों की अपेक्षा घटनाओं का निरीक्षण तुम भिन्न प्रकार से करते हो जिसके कारण उनसे तुम्हारा मतभेद हो जाता है
[✓ (क) हां,] (ख) कभी-कभी, (ग) नहीं ।

४५. स्कूल के बाद तुम क्या करना चाहोगे ?
(क) ऐसा कार्य जिससे लोग तुम्हें गरीब होते हुए भी पसन्द करें; (ख) अनिश्चित, (ग) खूब पैसा कमाना ।

४६. तुम क्या बनना चाहोगे ?
(क) स्कूल में सबसे लोकप्रिय विद्यार्थी, (ख) अनिश्चित, [✓ (ग) सर्वोत्तम अंक पाने वाला विद्यार्थी ।]

४७. जो भी तुम करते हो क्या उसके बारे में दृढ़ और निश्चित रहते हो ?
(क) शायद ही कभी, (ख) कभी-कभी, [✓ (ग) हमेशा ।]

४८. उन लोगों के साथ जो प्रश्न का उत्तर देने में बहुत देर लगाते हैं, तुम क्या करते हो ?
(क) चाहे जितनी भी देर लगे बोलने देते हो, (ख) दोनों के बीच में, [✓ (ग) उनका उत्तर जल्दी समाप्त करने की कोशि
करते हो और अगर वह अधिक समय लगाते हैं तो बीच में ही काट देते]

४९. क्या तुम्हारे हृदय को आसानी से ठेस लग जाती है ?
[✓ (क) हां,] (ख) शायद, (ग) नहीं ।

५०. क्या तुमको सुन्दर नाच देखने के बजाय कुश्ती देखना अच्छा लगता है ?
(क) हां, [✓ (ख) शायद,] (ग) नहीं ।

५१. यदि कोई तुम्हारे प्रति निर्दयता करता आया हो तो क्या तुम उस पर सरलता से विश्वास करके उसको एक और अवसर दे देते
[✓ (क) हां,] (ख) शायद, (ग) नहीं ।

५२. अवकाश का समय तुम कैसे व्यतीत करोगे ?
(क) टिकट संग्रह द्वारा स्वयं कोई पुस्तक पढ़ करके, (ख) अनिश्चित, [✓ (ग) किसी के आदेशानुसार सामूहिक योजना कार्य करके ।]

५३. क्या तुमको लगता है कि हर अपेक्षित कार्य को करते हुए तुम ठीक-ठाक थक पड़े हो ?
[✓ (क) हां,] (ख) शायद, (ग) नहीं ।

५४. क्या किसी नये फैशन के शुरू होने पर :
(क) तुम उसे फौरन अपना लेते हो, (ख) अनिश्चित, [✓ (ग) सोच-विचार करके कुछ समय बाद अपनाते]

५५. क्या तुम कभी-कभी अध्यापक को कक्षा में चर्चा के लिए कोई नया विषय सुझाते हो ?
(क) हां, (ख) अनिश्चित, [✓ (ग) नहीं ।]

५६. जब तुम साहसिक कहानी पढ़ते हो, तो क्या :
(क) उसके सुखमय अन्त के लिए चिन्तित रहते हो, (ख) अनिश्चित, [✓ (ग) कहानी के पढ़ने में आनन्द लेते हो ?]

५७. जब तुम किसी महत्वपूर्ण खेल में बुरी तरह से हार जाते हो, तो क्या तुम :
[✓ (क) कहते हो कि यह तो केवल खेल है,] (ख) अनिश्चित, [✓ (ग) नाराज हो जाते हो और अपने आपको धिक्कारते]

५८. जब तुम नये लोगों के बीच में जाते हो, तो क्या :
(क) शीघ्र ही तुमको लगता है कि जैसे सबको जान गये हो, (ख) दोनों के बीच में, [✓ (ग) लोगों को जानने में काफी समय लगता है ?]

५९. "धनी" का "पैसे" से वही सम्बन्ध है जो "दुःखी" का :
[✓ (क) परेशानी,] (ख) मित्र, (ग) भूमि से है।

६०. "चित्र" का "दृश्य" से वही सम्बन्ध है जो "उपन्यास" का :
(क) मुहल्ला, (ख) इतिहास, [✓ (ग) पुस्तक से है।]

६१. क्या तुम अक्सर बड़ी-बड़ी योजनाएं बनाते और उनके बारे में उत्तेजित रहते हो तथा अन्त में सोचते हो कि वह पूरी नहीं हो सकती?
[✓ (क) हां,] (ख) यथाकदा, (ग) नहीं।

६२. तुम्हारे कोई चीज निर्माण करते समय अगर कुछ चीजें टूट जायें या अचानक नष्ट हो जायें तो क्या तुम शान्त रह पाते हो ?
(क) हां, [✓ (ख) शायद,] [✓ (ग) नहीं, मुझे बहुत क्रोध आता है।]

६३. क्या तुमने अपने माता-पिता से कभी भी यह कहा है कि कुछ अध्यापक बहुत ही पुराने फैशन के हैं और वह आजकल के युवकों को (जैसे तुम और तुम्हारे दोस्त) समझ नहीं पाते ?
(क) हां, (ख) शायद, [✓ (ग) नही।]

६४. क्या तुम ऐसे अध्यापकों को अधिक पसन्द करते हो जो तुमको बतायें कि कार्य किस तरह करना चाहिये ?
[✓ (क) हां,] (ख) शायद, (ग) नहीं।

६५. क्या तुम उन लोगों में से हो जो अपनी मित्र-मंडली में हंसी-मजाक के चुटकुले सुनाया करते हैं ?
(क) हां, [✓ (ख) शायद,] (ग) नहीं।

६६. क्या तुम प्रति सप्ताह अपने जेब खर्च का अधिकांश भाग मौज उड़ाने में खर्च कर देते हो [बजाय इसके कि काफी भाग भविष्य की आवश्यकताओं के लिये बचाओ] ?
(क) हां, [✓ (ख) शायद,] (ग) नहीं।

६७. अगर लोगों की नजरें तुम्हारे कार्य पर लगी हों, फिर भी क्या तुम बिना अधिक त्रुटियां किये कार्य अच्छी तरह कर सकते हो ?
[✓ (क) हां,] (ख) शायद, (ग) नहीं।

६८. क्या किसी चीज के आजमाने में तुम्हें संकोच होता है चाहे तुमको पता हो कि उसमें खतरा नहीं है ?
[✓ (क) हां,] (ख) शायद, (ग) नहीं।

६९. तुम कौन सा विषय लेना पसन्द करोगे ?
[✓ (क) गणित,] (ख) अनिश्चित, (ग) साहित्य :

७०. जब तुम अपनी मित्र-मंडली में होते हो तो अधिक समय किसमें व्यतीत करते हो ?
(क) दोस्ती का आनन्द लेने में, (ख) अनिश्चित, [✓ (ग) जो हो रहा है उसे देखने में।]

७१. क्या तुमने कभी यह सोचा है कि अगर संसार में केवल तुम ही एक व्यक्ति रह जाओ तो क्या करोगे ?
(क) हां, (ख) अनिश्चित, [✓ (ग) नहीं।]

७२. किसी के गुनगुनाने पर क्या वही धुन तुम भी गुनगुनाने लगते हो ?
(क) हां, (ख) अनिश्चित, [✓ (ग) नहीं।]

७३. आगे तुम क्या पसन्द करोगे ?
(क) पुलों का निर्माण करना, [✓ (ख) अनिश्चित,] (ग) चलते फिरते सर्कस की पार्टी का सदस्य होना।

७४. स्कूल में अवकाश (खाली समय) के समय तुम क्या करोगे ?
(क) ताश खेलोगे, (ख) अनिश्चित, [✓ (ग) घर के लिये जो काम मिला है उसको करोगे ?]

७५. क्या तुम साधारणतया
[✓ (क) स्वयं निर्णय करते हो कि क्या ठीक है,] (ख) अनिश्चित, (ग) जैसे और लोग करते हैं वैसे ही करते हो ?

७६. जब तुम अंधेरी सुनसान गली में चल रहे होते हो तो क्या अक्सर तुमको लगता है कि कोई तुम्हारा पीछा कर रहा है ?
(क) हां, (ख) शायद, [✓ (ग) नहीं।]

७७. तुम कहाँ रहना पसन्द करोगे ?
(क) एक निर्जन घने जंगल में जहाँ केवल चिड़ियों का संगीत है, (ख) अनिश्चित, [✓ (ग) सड़क के किनारे जहाँ खूब चहल-पहल रहती है।]

७८. "प्रायः" का अर्थ होता है :
(क) कभी-कभी, (ख) हमेशा, [✓ (ग) बहुधा।]

७९. अगर सब देवदार के पेड़ नोंकदार होते हैं और जितने नोंकदार पेड़ होते हैं वह हमेशा हरे रहते हैं तो नीचे लिखी कौनसी बात सत्य है ?
[✓ (क) सब देवदार के पेड़ हमेशा हरे रहते हैं,] (ख) सब हरे रहने वाले पेड़ देवदार के पेड़ होते हैं, (ग) सब देवदार के पेड़ नोंकदार होते हैं।

८०. तुम्हारी उम्र के एक सामान्य व्यक्ति से जो अपेक्षा की जाती है, क्या तुम उसका दुगना कर सकते हो ?
(क) हाँ, (ख) शायद, [✓ (ग) नहीं।]

८१. रेडियो सुनते समय अगर तुम्हारे पास कोई [illegible]
(क) तुम बिना विघ्न किये रेडियो सुन सकते हो, (ख) [illegible] के बीच में, [✓ (ग) सब किरकिरा हो जाता है और तुमको झुँझलाहट होती है ?]

८२. यदि तुम जीव-विज्ञान के किसी विद्यार्थी के साथ दौरे पर निकलो तो तुमको किसमें अधिक आनन्द आयेगा ?
(क) चिड़ियाँ पकड़ने और उनको पिंजड़े में रखने में, (ख) अनिश्चित, [✓ (ग) चिड़ियों की सुन्दर फोटो या चित्र बनाने में।]

८३. क्या तुम अपने दोस्तों में इस बात के लिये प्रसिद्ध हो कि तुम अपने सामाजिक कार्यों की पूर्ति के लिए कुछ भी कर सकते हो ?
(क) हाँ, (ख) शायद, [✓ (ग) नहीं।]

८४. सामूहिक योजनाओं में तुम किस रूप में कार्य करना पसन्द करोगे ?
(क) एक प्रमुख नेता के रूप में, (ख) दोनों के बीच में, [✓ (ग) एक अच्छे अनुयायी के रूप में।]

८५. क्या अक्सर लोग तुम्हारे रास्ते में अड़चनें डाल रहे हैं ?
(क) हाँ, (ख) शायद, [✓ (ग) नहीं।]

८६. क्या तुम अपनी कक्षा के सामने बिना किसी घबराहट और परेशानी के खड़े हो सकते हो ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

८७. क्या तुमको लगता है कि स्कूल में तुम्हारे अध्यापक :
[✓ (क) तुम्हें जानते हैं,] (ख) अनिश्चित, (ग) कदाचित् तुम्हें जानते भी न हों।

८८. जब तुम सिनेमा में कोई बहुत ही दुःखद घटना देखते हो तो क्या
(क) तुम्हें आँसुओं को रोकना कठिन हो जाता है, [✓ (ख) अनिश्चित,] (ग) तुम [illegible] हो कि यह सब तो केवल काल्पनिक है ?

८९. अगर कोई कार्य सामूहिक रूप में किया जाना हो, तो क्या अक्सर तुमको यह कहने की इच्छा होती है कि
(क) इस काम को हम सब लोग मिलकर कर लेंगे, (ख) अनिश्चित, (ग) मैं इसमें सम्मिलित नहीं होऊँगा।

९०. स्कूल में नीचे लिखे कौन से कार्यक्रम के लिए तुम अपनी सहमति दोगे ?
(क) कक्षा में पिछड़ने वाले विद्यार्थियों की अलग कक्षाएँ बनायी जाएँ, (ख) अनिश्चित, [✓ (ग) अनावश्यक खर्च का बहिष्कार किया जाय।]

९१ जब तुम्हारे काम आशाजनक रूप से हो रहे हों, तो क्या तुम
[✓ (क) प्रायः खुशी में उछल पड़ते हो,] (ख) अनिश्चित, (ग) मन ही मन खुश होकर ऊपर से शांत रहते हो ?

९२. क्या तुम उन बहुत से लोगों की तरह हो जो आसमान में बिजली चमकने से कुछ डर जाते हैं ?
[✓ (क) हाँ,] (ख) शायद, (ग) नहीं।

९३. क्या तुम सोचते हो कि तुम्हारी मित्र-मण्डली मिलकर जो निर्णय लेती है वे किसी एक व्यक्ति के निर्णय से बढ़िया होते हैं और उनमें समय अधिक लगता है ?
(क) हाँ, (ख) शायद, [✓ (ग) नहीं।]

९४. किसी कार्य को [illegible] इच्छा होने पर क्या तुम उसे कर डालते हो, चाहे उसमें कुछ व्यय ही क्यों न लगे ?
(क) हाँ, (ख) शायद, [✓ (ग) नहीं।]

९५. यदि कोई तुम [illegible] बातों से असहमत हो, तो क्या तुम :
(क) उसकी [illegible] बीच में काट देते हो, (ख) अनिश्चित, [✓ (ग) उसे अपनी पूरी बात कह लेने का मौका देते हो ?]

९६. जब कोई नया अध्यापक तुम्हारी कक्षा में आता है, तो क्या उसकी दृष्टि तुम पर जल्दी पड़ जाती है और वह तुमको याद रख पाता है ?
(क) हां, [✓ (ख) शायद,] (ग) नहीं।

९७. इन पांच शब्दों को देखो : नीचे, निकट, ऊपर, पीछे, बीच में। कौनसा वह शब्द है जो औरों से मेल नहीं खाता है ?
(क) नीचे, [✓ (ख) बीच में,] (ग) निकट।

९८. क्या तुम बिना किसी वास्तविक कारण के कभी-कभी बहुत उदास हो जाते हो ?
[✓ (क) हां,] (ख) अनिश्चित, (ग) नही।

९९. अगर कोई तुमसे किसी नये और कठिन कार्य को करने के लिये कहता है, तो क्या तुम :
(क) खुश होते हो और अपनी योग्यता का परिचय देते हो, (ख) शायद, [✓ (ग) ऐसा अनुभव करते हो कि कहीं गड़बड़ न हो जाय ?]

१००. कक्षा में पूछे गये प्रश्न का उत्तर देने के लिये जब तुम अन्य छात्रों के साथ हाथ उठाते हो, तो क्या उत्तेजित हो जाते हो ?
[✓ (क) कभी-कभी,] (ख) अक्सर नहीं, (ग) कभी नहीं।

१०१. स्कूल में तुम क्या बनना पसन्द करोगे ?
(क) एक ड्राइंग टीचर, (ख) अनिश्चित, [✓ (ग) व्यायाम सिखाने का एक शिक्षक।]

१०२. तुम क्या पसन्द करोगे ?
[✓ (क) अनोखे साहसी कार्यों की कहानी पढ़ना,] (ख) अनिश्चित, (ग) स्वयं अनोखे साहसी कार्य करना।

१०३. तुम मुख्यतः कैसे व्यक्ति माने जाते हो ?
(क) विचारशील, [✓ (ख) दोनों के बीच में.] (ग) क्रियाशील।

१०४. कक्षा में कोई भी बात करने के पहले क्या तुम सावधानी से निश्चय कर लेते हो कि बात सही है ?
(क) हमेशा, [✓ (ख) साधारणतः] (ग) प्रायः नहीं।

१०५. क्या तुम किसी भी पक्ष में निर्णय इसलिये नहीं कर पाते कि उसके परिणामों से बहुत डरते हो ?
(क) अक्सर, (ख) कभी-कभी, [✓ (ग) कभी नहीं।]

१०६. क्या तुम्हारी रुचियां :
(क) बहुत सी चीजों पर भटकती रहती हैं, [✓ (ख) दोनों के बीच में,] (ग) एक या दो महत्वपूर्ण चीजों पर जम गई हैं ?

१०७. जब तुम्हारा कोई घनिष्ट मित्र किसी विशेष अवसर पर तुम्हारी अपेक्षा किसी अन्य व्यक्ति का साथ अधिक पसन्द करता है, तो क्या तुम:
(क) उससे शिकायत करते हो कि उसने तुम्हारी उपेक्षा की है, (ख) दोनों के बीच में, [✓ (ग) सोचते हो कि ऐसा तो हो ही जाता है ?]

१०८. सामूहिक वाद-विवादों में क्या तुम अक्सर महसूस करते हो कि :
(क) तुम्हारा पक्ष सबसे भिन्न है, [✓ (ख) अनिश्चित,] (ग) तुम्हारा पक्ष सबसे मेल खाता है ?

१०९. जब तुमको लाइन में खड़े होकर प्रतीक्षा करनी पड़ती है तो क्या तुम प्रायः
[✓ (क) शान्ति से प्रतीक्षा करते हो,] (ख) अनिश्चित, (ग) अधीर हो उठते हो और बजाय खड़े होने के चले जाने की सोचते हो ?

११०. क्या तुमको ऐसा लगता है कि तुम्हारी भावनाएं इतनी घुट रही हैं कि तुम रो पड़ो ?
(क) अक्सर, (ख) कभी-कभी, [✓ (ग) शायद ही कभी।]

१११. तुम किस प्रकार के दोस्त पसन्द करते हो ?
(क) जो चुलबुले एवं चंचल हों, (ख) अनिश्चित, [✓ (ग) काफी गम्भीर हों।]

११२. क्या तुम सोचते हो कि विनम्र होने के लिये यह आवश्यक है कि अपनी भावनाओं पर काबू रखना सीखा जाय ?
[✓ (क) हां,] (ख) शायद, (ग) नही।

११३. क्या छोटी-छोटी परेशानियों से तुम कभी-कभी बहुत बेचैन हो जाते हो, हालांकि तुम जानते हो कि वह बहुत महत्वपूर्ण नहीं है ?
[✓ (क) हां,] (ख) शायद, (ग) नहीं।

११४. क्या तुम निश्चित हो कि तुमने प्रत्येक प्रश्न का उत्तर दे दिया है ?
[✓ (क) हां,] (ख) शायद, (ग) नहीं।

उत्तर-पत्र

The Jr.-Sr. H. S. P. Q. FORM . . . . . .

नाम . . . . स्कूल/कॉलेज . . . . कक्षा . . . .

दिनांक . . . . स्त्री/पुरुष . . . . . . पिता या अभिभावक की मासिक आय रु० . . . . आयु . . . . . . वर्ष . . . . माह

निर्देश—अपनी पुस्तिका में दिए गए प्रश्न संख्या के अनुसार नीचे के खाने (Box) में एक सही का निशान (√) लगाओ।

	(अ)	(ब)	(स)		(अ)	(ब)	(स)
उदाहरण—१.	☐	☐	☐	२	☐	☐	☐

	पृष्ठ २				पृष्ठ ३				पृष्ठ ४				पृष्ठ ५				पृष्ठ ६				पृष्ठ ७		
	(अ)	(ब)	(स)		(अ)	(ब)	(स)		(अ)	(ब)	(स)		(अ)	(ब)	(स)		(अ)	(ब)	(स)		(अ)	(ब)	(स)
१	☐	☐	☐	२०	☐	☐	☐	३९	☐	☐	☐	५८	☐	☐	☐	७७	☐	☐	☐	९६	☐	☐	☐
२	☐	☐	☐	२१	☐	☐	☐	४०	☐	☐	☐	५९	☐	☐	☐	७८	☐	☐	☐	९७	☐	☐	☐
३	☐	☐	☐	२२	☐	☐	☐	४१	☐	☐	☐	६०	☐	☐	☐	७९	☐	☐	☐	९८	☐	☐	☐
४	☐	☐	☐	२३	☐	☐	☐	४२	☐	☐	☐	६१	☐	☐	☐	८०	☐	☐	☐	९९	☐	☐	☐
५	☐	☐	☐	२४	☐	☐	☐	४३	☐	☐	☐	६२	☐	☐	☐	८१	☐	☐	☐	१००	☐	☐	☐
६	☐	☐	☐	२५	☐	☐	☐	४४	☐	☐	☐	६३	☐	☐	☐	८२	☐	☐	☐	१०१	☐	☐	☐
७	☐	☐	☐	२६	☐	☐	☐	४५	☐	☐	☐	६४	☐	☐	☐	८३	☐	☐	☐	१०२	☐	☐	☐
८	☐	☐	☐	२७	☐	☐	☐	४६	☐	☐	☐	६५	☐	☐	☐	८४	☐	☐	☐	१०३	☐	☐	☐
९	☐	☐	☐	२८	☐	☐	☐	४७	☐	☐	☐	६६	☐	☐	☐	८५	☐	☐	☐	१०४	☐	☐	☐
१०	☐	☐	☐	२९	☐	☐	☐	४८	☐	☐	☐	६७	☐	☐	☐	८६	☐	☐	☐	१०५	☐	☐	☐
११	☐	☐	☐	३०	☐	☐	☐	४९	☐	☐	☐	६८	☐	☐	☐	८७	☐	☐	☐	१०६	☐	☐	☐
१२	☐	☐	☐	३१	☐	☐	☐	५०	☐	☐	☐	६९	☐	☐	☐	८८	☐	☐	☐	१०७	☐	☐	☐
१३	☐	☐	☐	३२	☐	☐	☐	५१	☐	☐	☐	७०	☐	☐	☐	८९	☐	☐	☐	१०८	☐	☐	☐
१४	☐	☐	☐	३३	☐	☐	☐	५२	☐	☐	☐	७१	☐	☐	☐	९०	☐	☐	☐	१०९	☐	☐	☐
१५	☐	☐	☐	३४	☐	☐	☐	५३	☐	☐	☐	७२	☐	☐	☐	९१	☐	☐	☐	११०	☐	☐	☐
१६	☐	☐	☐	३५	☐	☐	☐	५४	☐	☐	☐	७३	☐	☐	☐	९२	☐	☐	☐	१११	☐	☐	☐
१७	☐	☐	☐	३६	☐	☐	☐	५५	☐	☐	☐	७४	☐	☐	☐	९३	☐	☐	☐	११२	☐	☐	☐
१८	☐	☐	☐	३७	☐	☐	☐	५६	☐	☐	☐	७५	☐	☐	☐	९४	☐	☐	☐	११३	☐	☐	☐
१९	☐	☐	☐	३८	☐	☐	☐	५७	☐	☐	☐	७६	☐	☐	☐	९५	☐	☐	☐	११४	☐	☐	☐
	पृष्ठ २ समाप्त				पृष्ठ ३ समाप्त				पृष्ठ ४ समाप्त				पृष्ठ ५ समाप्त				पृष्ठ ६ समाप्त				पृष्ठ ७ समाप्त		

DO NOT WRITE HERE

FACTOR	SCORE	
	RAW	STD
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		
O		
Q2		
Q3		
Q4		

© Copyright, 1967, by The Psycho-Centre, New Delhi. All rights reserved. Printed in India.

प्रश्नपत्र।

- विद्यार्थी का नाम:-
- लड़का या लड़की:-
- आयु:-
- कक्षा:-
- सैक्शन:-
- स्कूल का नाम:-
- तिथि:-

(1) आपके पिता ने कहाँ तक शिक्षा प्राप्त की है।

(2) आपकी माता ने कहाँ तक शिक्षा प्राप्त की है।

(3) आपके पिता किस तरह का व्यवसाय करते हैं।

(4) क्या आप की माता भी किसी व्यवसाय में लगी है। (यदि हाँ तो व्यवसाय लिखिये।)

(5) आपके पिता की औसत आय प्रति माह कितनी है।

(6) पिता के अलावा आप के घर में और कितने लोग व्यवसाय में हैं तथा प्रत्येक की औसत आय प्रति माह कितनी है।

शिक्षा	व्यवसाय	आय	कुल योग

शिक्षा	व्यवसाय	आय	कुल योग

ANSWER SHEET

STANDARD

PROGRESSIVE MATRICS

SETS A,B,C,D& E.

A.	B	C	D	E
1.-	1.	1-	1-	1-
2.	2.	2-	2-	2-
3-	3-	3-	3-	3-
4-	4-	4-	4-	4-
5-	5-	5-	5-	5-
6-	6-	6-	6-	6-
7-	7-	7-	7-	7-
8-	8-	8-	8-	8-
9-	9-	9-	9-	9-
10-	10-	10-	10-	10
11-	11-	11-	11-	11-
12-	12-	12-	2-	12-
Total				